Water Use for Injection Purposes in Alberta

Prepared for: Alberta Environment

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EXECUTIVE SUMMARY

This report provides the results of an examination of water use data submitted to Alberta Environment (AENV) and the Alberta Energy and Utilities Board (EUB) by oil producers. The objectives of the examination were to assemble and analyze the data to gain a better picture of water volumes used for injection purposes in Alberta.

The data was provided by EUB and AENV. The majority of EUB's data came from the Production Injection Database (PID). This data includes reported volumes of source water diverted and project-related data regarding oil produced, water injected, and water produced. AENV data consisted of water approval information from AENV's Environmental Management System (EMS) database and water use report information, which is recorded in hardcopy files and microfiche.

The data from the different sources have been assembled into a common database, and links and attributes have been created for future data use and analysis. Ground water sources have been classified as either saline or non-saline. A series of analysis has been done to identify quantities and trends of water use.

Based on available data, 47.5 million m^3 of water for injection were diverted from surface and ground water sources in 2001. The amount of water diverted for injection has been in decline since 1973, when the industry diverted 88.7 million m^3.

The total volume of injectant has steadily increased, with the majority of the injectant coming from recycled water. Water balance analysis shows that recycle rates are increasing.

For conventional projects, the volume of source water used was 37.3 million m^3 in 2001. The total volume of injectant, including source water and recycled water, was 243 million m^3.

For thermal projects, source water use in 2001 was 10.2 million m^3. Source water used for thermal projects comes mainly from surface and non-saline ground water sources. The total volume of injectant in 2001 for thermal projects, including source water and recycled water, was 33.0 million m^3.

The data indicates that total source water use has noticeably declined in the Green Zone, while the trend in the White Zone is more complex.

Saline groundwater has increasingly displaced the use of non-saline groundwater and surface water in the White Zone.

The volume of surface water use has declined from a high of over 70 million m^3 in 1974 to 26.9 million m^3 in 2001. The volume of saline water use has increased from 1.7 million m^3 in 1972 to over 10 million m^3 in 2001. Use of non-saline ground water has decreased from 17.2 million m^3 in 1973 to 10.1 million m^3 in 2001.

ACKNOWLEDGEMENTS

Geowa Information Technologies, Ltd. acknowledges the contributions from the staff of EUB, Alberta Environment, and Alberta Department of Energy in the preparation of this report. Their efforts made both in providing data and assisting in the analysis of the data are greatly appreciated.

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INTRODUCTION

Geowa Information Technologies, Ltd. was commissioned by Alberta Environment (AENV) to compile data, provide historical analysis, and develop a database of water use for oilfield injection, which includes water used in the enhanced recovery (EOR) of conventional oil and the thermal recovery of crude bitumen. This initiative is part of *Water for Life: Alberta's Strategy for* Sustainability, which aims to ensure reliable, quality water supplies for a sustainable economy.

The background section of this report discusses in detail the processes of conventional and thermal EOR and the regulations that affect water used in these processes. The objectives and scope and limitations sections follow. The sources of data section gives a description of the tables used. The data management section discusses additions to the data to enable linking and analysis of the data tables. The data considerations section addresses issues and considerations for maintaining and updating the data.

In the results section, the data is used to determine volumes and trends of water use. The Conclusions summarize the key findings regarding data and the analysis.

The appendix of this report (under separate cover) presents a complete collection of charts and tables from the analysis of data.

BACKGROUND

The availability, quality and use of water are growing concerns in Alberta. In recent years, drought conditions in various regions of the province have compounded these concerns. Many Albertans have raised these concerns at numerous community workshops for *Water for Life*, specifically regarding the use of water for oilfield injection.

The petroleum industry uses water in various ways, including hydrostatic testing of pipelines, supplying drilling rigs and camps with water for drilling, and providing water for human consumption, sanitization, and fire protection. These types of water uses may be of local concern and part of any potential future study of industrial water use, but they are not part of the allocated volumes for oilfield injection and are not part of this report.

Additional water is also used for ore processing and cooling in the mining of crude bitumen. This large-scale use of water by the petroleum industry is concentrated in the area near Fort McMurray. This use of water, which is distinct from the injection of water into oil reservoirs, is not the subject of this report and has not been included in the data tables or analyses.

Water is used to enhance recovery of hydrocarbons by either 'waterflood' or tertiary projects in conventional oil pools or to generate steam for the recovery of crude bitumen in the oil sands areas. The volume of reservoir fluid produced partly determines the volume of make-up water required for injection. The reservoir fluid consists of hydrocarbons and produced water. A normal EUB project requirement is to replace the produced reservoir fluids by an injectant (normally water or a combination of solvent and water). Additional make-up water would also be needed to replace the expected increase in hydrocarbon production due to the success of the waterflood process and any repressuring required. If the reservoir pressure has been depleted during primary production, additional make-up water volumes may be needed to prevent the separation of dissolved gas and oil within the oil reservoir. If the project's wells are operated above the reservoir's bubble point, the volume of make-up water required will be only for the oil produced.

With time, produced water from the project will increase. As it is an expectation that the produced water is returned to the zone of origin (re-

injected into the project's injection wells), the volume of make-up water required may be reduced. If the water/solvent injectors are not designed/equipped to handle the produced water, this water may be injected into a EUB-approved disposal well(s) or transferred to another nearby waterflood project to be recycled.

Recovery of crude bitumen by steam-assisted gravity drainage (SAGD) involves horizontal well-pairs drilled 5 to 10 metres vertically above one another. The process consists of continuous injection of steam into the formation through an injector (the top well), which lowers the viscosity of crude bitumen enough that it drains into the production wellbore (the bottom well). Recovery of crude bitumen or heavy density oil by cyclical steam stimulation (CSS) consists of intermittent slugs of steam in a wellbore that heat the area near the wellbore to reduce the heavy oil viscosity and allow drainage to begin. Injection and production of crude bitumen is through the same wellbore; cyclic process was previously known as "Huff 'n Puff". The steam requirements and quality vary, and the economics of generating the steam is a major factor.

Alberta Environment administers the *Water Act*, which requires anyone proposing to divert and use water for oilfield injection purposes to obtain a licence.

Water use has been regulated in Alberta since the late 1800s when the federal *Northwest Irrigation Act* was passed. In 1931, when responsibility for natural resources was transferred from the federal government, the Alberta *Water Resources Act* superseded the previous legislation. It was replaced in 1999 by the *Water Act*, which is administered by Alberta Environment.

The requirement to obtain a licence to divert ground water was added to the *Water Resources Act* in 1962. A 1971 revision to the Act further addressed licensing of ground water and required users to retroactively register its use prior to April 1971. By mid 1981, the approval to divert and use ground water for EOR projects took the form of a Permit with an expiry date.

Licences to divert surface water were issued for indefinite terms prior to 1999 but are now issued with expiry dates as Term Licences under the *Water Act*. Requirement to obtain a licence to use saline ground water was removed from the Act in January 1999.

The Ground Water Allocation Policy for Oilfield Injection Purposes was implemented in March 1990. The policy specifically addresses the use

of non-saline ground water in the White Zone of the province. Proponents must investigate alternate sources using non-saline water and demonstrate that no viable sources are available prior to the submission of a *Water Act* application. Non-saline ground water is restricted to a maximum of one half of the long-term yield of a given aquifer in the immediate vicinity of the water source well. All initial authorizations are limited to a one-year time period. A first five-year extension is issued only if the aquifer is performing in accordance with the terms and conditions of the authorization. Future extensions are granted automatically for five-year time periods if the required conditions are met and no applications that exceed the remaining available aquifer capacity have been received.

The EUB approves petroleum industry applications (Guide 65) to implement projects for enhanced oil recovery of conventional oil. A normal EUB project requirement is to replace the produced reservoir fluids by an injectant (normally water or a combination of solvent and water). The EUB also approves the development of thermal (in-situ) projects in oil sands deposits and in conventional heavy density oil reservoirs.

In approving EOR and thermal projects, a prime EUB mandate is to collect, verify, and audit monthly production, injection, and disposal volumes throughout the province. Monthly volumes of water from surface and shallow diversion locations and from non-saline and saline ground water wells are also collected to facilitate a one-window approach to data collection on behalf of AENV.

Under EUB regulations, a well licence (as per Guide 56) for any water source well that is to be drilled to a depth greater than 150 m must be obtained. In accordance with EUB Guide 7, volumes of water diverted from a water well drilled to a depth less than 150 m, or a withdrawal point along a river or lake, must be reported monthly if the water is used for oilfield injection.

OBJECTIVES

The objectives of this study were to:

- Compile water use data relating to conventional and thermal oil recovery projects in Alberta.
- Organize and link the data from separate databases.
- Organize the data to allow for more-site specific analysis.
- Analyze the data in various ways to determine values and trends in source water use, the type of source water being used, and the rate of water recycling being carried out.
- Make the data gathered for this report accessible for future analysis and study.
- To provide attributes and linkages between relevant portions of the EUB and AENV databases to assist in developing a method to permanently coordinate the data sets.

SCOPE AND LIMITATIONS

The water use examined in this report is restricted to that used for enhanced recovery of oil (EOR) using both conventional and thermal processes. Other water used by the petroleum industry is not included in this study.

The data in this study includes reports submitted to EUB and AENV by oil producers as requirements of their licences and approvals. The data is presumed accurate subject to the understandable types of errors that occur in measurement, recording, data entry, and other such types of errors.

Some values used in the water balance portion of the analysis were calculated because values for water disposal and water recycle were not reported directly for each EOR project, and were not available for this study on a project by project basis. The calculations are based on simple relationships between the material balance components in the consolidated data sets. The value of these calculations is more to identify problems with the data and possibly to identify missing information rather than to draw hard conclusions about volumes of disposal and recycle.

The Background and the Glossary have been created with input from Alberta Department of Energy, EUB, and AENV. The description of the processes, policies, and terms are given for the purpose of understanding this report only.

SOURCES OF DATA

Alberta Environment

Identification of relevant files

Alberta Environment provided a historical list of all active, cancelled, and expired water diversion authorizations under the *Water Act* that were specifically coded for injection purposes in their Environmental Management System (EMS) database. EMS is a large multi-table relational database used by AENV to track and store information about approvals granted by the department.

The AENV approvals table consisted of 1295 records, each relating to a specific Water Allocation (WA) identification number. The records contained 26 fields of data, including approval holder's name, location, status, and maximum annual allocation. Ground water projects are usually located to the nearest legal subdivision, while surface water projects to the nearest quarter section. The WA number is assigned by EMS when the details of an approval are added to the database. This number does not appear on documents or within files. The normal way of relating documents and correspondence to information in the database is by file number or priority number. The data is updated and maintained by the staff that administers the *Water Act*.

The approvals are issued from regional offices located throughout the province. The hardcopy files including the water use reports are located at these centres. Historical microfiche of some of the files is available at AENV head office in Edmonton.

Identification and amalgamation of Water Allocation ID numbers

Understanding the EMS database is important for linking the AENV approvals data to AENV water use reports. In general, one Water Allocation (WA) Identification (ID) number in the EMS database relates to one water source. However, in some cases, a single source is related to more than one WA number. This may be because a surface source has two priority numbers based an initial application and a subsequent application for increase of annual allocation. Wells with two production zones may also be related to two WAs. A new field in an interim database called "WA_Pseudo" was created so that one EUB location could be linked to more than one Water Allocation ID number.

Collection of AENV water use data

A manual review of files was completed to collect and record water use data submitted to AENV by authorization holders. The data was obtained from either hardcopy files in the regional offices or microfiche at head office. The data was recorded into a database using a specially developed program. The reports were either for one source or a group of sources. Careful notation in the database table was made when the AENV data was associated with more than one Water Allocation ID number.

Since hardcopy data usually uses the file number as a reference, a small program was developed to enable the reviewers to quickly view all WAs associated with a particular file number or land location so they could decide which WA to associate with a particular water use report. Data was recorded from summary sheets or from the actual water use reports. Many ground water files had computer printout summary sheets of monthly and yearly data for the 1972 to 1983 period. Similarly, surface water files prior to 1971 contained a summary sheet of annual surface water diversions for the period of 1971 to 1973. For years where the data were not recorded on summary sheets, annual water use return forms were reviewed. Monthly records were used in cases where annual returns were unavailable.

Units were usually provided in acre-feet, less often in cubic metres, and rarely in barrels or (Imperial or U.S.) gallons. All volumes recorded for this report have been converted to cubic metres.

Data verification and adjustment

A number of queries and sorts were used to verify the data and identify data entry errors. By summing the volumes by quarter section in the EUB data and AENV data, a number of ground water summary sheets for 1972 to 1983 were identified as incorrect by a factor of ten. Appropriate adjustments were made to the data set.

Comparing individual EUB water use reports to AENV reports is possible, but it is cumbersome without relational linkages between the data sets. The data linkages developed during this study are discussed on page 18.

EUB

Source water data

EUB provided source water data from their Production Injection Database (PID), which included an annual water use volume from each water source location over the past 30 years. This data was provided in three spreadsheets. Each row in the sheet contained an identifier with an embedded location, a year, annual use, cumulative use, and an associated oil field. In the shallow and surface table, the oil field was always identified, as "miscellaneous" while the licensed table records are associated with real oil fields. Each spreadsheet contained information on a different type of source water as follows:

Licensed—Wells of depth greater than 150 metres
Shallow—ground water wells.
Surface—lake or river withdrawal locations.

The licensed table included 1080 separate locations, of which 371 were active in 2001. The shallow table included 303 locations, of which 96 were active in 2001, while the surface table included 193 locations, with 59 active.

Only the wells from the licensed table require an approval from EUB (EUB Guide 56). The shallow ground water and surface sources are required to be licensed by AENV prior to diversion. EUB requires monthly water use volumes to be reported from all water sources (EUB Guide 7).

A description of the internal structure of the PID was not provided to GEOWA by the EUB for inclusion in this report; however, it was noted that a good understanding of the data is required to reproduce reliable information. The management and retrieval of data from large databases such as the PID requires extensive training and experience that is specific to the particular data and the database management system employed for that application.

Determination of saline and non-saline ground water

A consistent criterion was required to classify sources as saline and or non-saline. For the purpose of this report, the "base of ground water protection" was established as the criterion for separation of saline and non-saline water. This level is defined in the database known as "EUB ST-55; *Alberta's Usable Ground Water Database*". EUB reviewed the records in the licensed table in the PID, and over 90 % of the active wells are now classified based on this criterion.

Alberta Environment's criteria for distinguishing between saline and non-saline ground water is based on the total amount of dissolved solids in the water. Water with a total dissolved solids (TDS) of less than 4000 mg/L is considered non-saline. A licence under the Water Act is required for the diversion of non-saline water. However the EUB requires licencing where production zones are deeper than 150 metres. Many of these wells have a TDS greater than 4000 mg/L.

Conventional EOR project data

EUB provided a text file that contains a 40-year history for 1277 approved EOR projects (active, inactive, or cancelled). The data was compiled from two EUB sources: the Enhanced Recovery Surveillance (ERS) database, which interfaces monthly with PID to access the reported production and injection volumes, and the "Appendix to Project Approval", which was used to access the names of operators associated with the EOR projects within an EUB-designated field.

Each record in the file contains a field number, pool name, project number, annual oil production, and water production for the EOR project oil wells, and water injection volumes for approved EOR injection wells. To enable the location of the projects on a map, the location of the most south-eastern well within each project was also provided. The information also includes the start date of the project and the current operator.

Thermal recovery of crude bitumen (SAGD and CSS) project data

EUB provided annual steam production and injection volumes for thermal and primary projects for the three oil sands areas: Cold Lake, Athabasca, and Peace River. The data included annual crude bitumen and water production and steam injection volumes for the thermal projects and the crude bitumen and water production volumes for the primary projects. The data was compiled from the database known as BWO (basic well data for oil sands). This program, like ERS, interfaces with PID on a monthly basis.

Water disposal data

A spreadsheet file summarizing the historical annual water disposal volumes injected into approved disposal wells was provided by EUB. These wells and water disposal volumes are reported monthly to the EUB and recorded in PID. The origin of the water is primarily produced water from oil and gas wells.

Each row in the spreadsheet has an ID code in which the land location is embedded. In addition, each well is related to a field and a pool.

Water disposal data may include:

- Produced water from conventional primary oil and gas recovery operations.
- Produced water from conventional EOR oil operations, which may be in excess of injection requirements.
- Surface water gathered within the boundary of an oil and gas facility.
- Fluids used in well servicing activities.
- Water used in oil and gas processing facilities.

Figure 1 below provides Provincial Disposal Volumes.

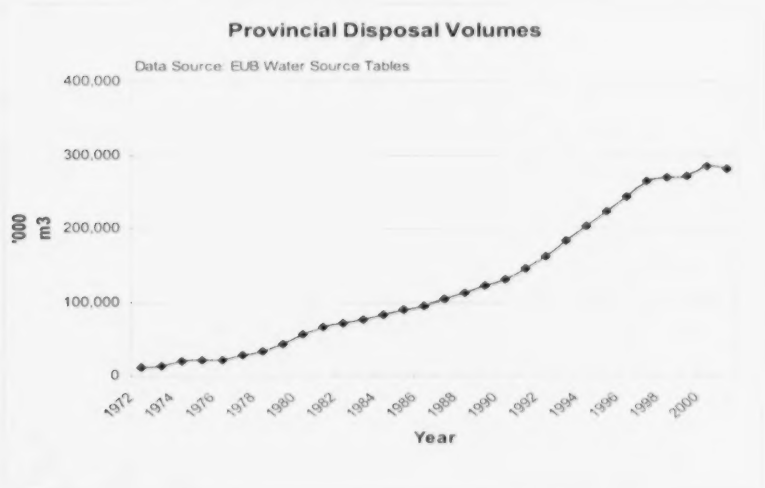

Figure 1: Provincial Disposal Volumes

DATABASE MANAGEMENT

Consolidation of data

EUB and AENV data were imported from the spreadsheets and text files into a Microsoft Access database for analyses, with new tables to store the AENV water use data and the consolidation of the three EUB source water tables into a table called "eubwatus". The data collected from AENV approvals is currently named "tblWaterUse".

"Eubwatus" initially contained years of record, for individual EOR projects, where no water use data was available. These records have been removed. Each record in "eubwatus" has a unique identifier so it may be traced back to its table of origin. The original spreadsheets and intermediate tables used to construct "eubwatus" have been retained, and are included in the digital database constructed by GEOWA and provided to Alberta Environment. A number of fields were added to "eubwatus" to include latitude, longitude, source type, project type, zone, and drainage basin. A special field entitled "WA_ID" was created to link eubwatus data to the AENV approvals data. Eubwatus contains 20,033 records.

The "tblWaterUse" that summarizes AENV water use data includes WA, Year, annual use, units, annual use in cubic metres, and a comments field. Much of the information about linking the WA field in the table and the water use information from AENV files can be obtained from the comments field.

Deriving geographic coordinates from legal land descriptions

Most data in the AENV and EUB tables is associated with a legal land description. To enable spatial analysis of this data using GIS methods, legal land descriptions were converted into geographic coordinates (NAD 83) using a reference file purchased from AltaLis Ltd.

The basic algorithm for creating coordinates is as follows:

- Read the record from a table and determine the legal description.
- Go to the reference file and find the geographic coordinates of the NE corner of the section and create a custom UTM projection using the longitude of the NE corner as the central meridian.

- Based on the legal subdivision (LSD) or quarter section description, create a new point offset from the NE corner in UTM units. Save that point unprojected using the custom projection.
- Write the coordinates into the table.

Using this method will designate the project within the centre of the LSD. This process was performed on the project data, the water use data, and the AENV approval table. The AENV table had latitude and longitude information; however, some data was missing and other data appears inaccurate. The existing latitude and longitude data was kept but is not used.

Linking AENV water licence data to EUB source water data

A program was created to display the AENV approvals data and any EUB water use data located on the same section. The reviewer could then compare all the information at the same time. If there appeared to be a match, the reviewer could press a button to write the WA from the AENV record into the related records in the EUB tables, thus creating a link.

A second step was to plot the AENV approvals and EUB tables on a GIS map, compare the location, and if a match appeared likely, create a link. By the two methods, over 80% of the AENV records were linked to EUB data. Some of the remaining AENV records did not have a link to EUB data (the proponents may have obtained an approval from Alberta Environment but have not yet or did not exercise the right to divert water). There were also EUB records of water use from surface water and non-saline ground water sources that could not be linked to AENV records.

Linking source water data to thermal project data

The thermal project data is grouped into three broad areas, which are Cold Lake, Peace River and Athabasca. The method used to relate the source water data to one of the three thermal groups was deductive. It was presumed that conventional EOR projects would have source water locations nearby. There are no conventional projects near the thermal areas so all of the source water reported to the EUB in these areas was classified as being associated with thermal projects.

Linking source water data to conventional project data

The classification of conventional source water was done in a similar manner to thermal projects. Source water not associated with an area of thermal EOR projects has been classified as water used for conventional EOR. Figure 2 shows the locations of projects and source water in the province.

The PID database does not include data fields that link specific water sources to individual EOR projects.

In some areas, it was possible to identify the project or group of projects where source water from a single or group of sources was used. In many areas, however, the distribution of source water amongst various projects appeared too complex to make a linkage without making broad assumptions.

Figure 2: Location of all projects and source water since 1972

AENV water allocations

The total allocations granted for any given year were based on the dates the authorizations were issued and the dates the authorizations were cancelled. However, active ground water licences with priority numbers back as far as 1957 were not issued an authorization until after 1981. Many of these ground water diversion projects were ongoing prior to the 1971 revision of the *Water Resources Act* that required ground water diversion licensing. For those licences, the water licence priority number was used as the date of first operation.

Data arrangement

Data was augmented to include major drainage basin (Figure 3) and Green/White Zone (Figure 4) identification, based on boundaries supplied by AENV. The location of the oilfield recovery project was consistently applied to the most south-eastern oilfield recovery well as provided by EUB.

Some projects straddled a major basin or zone boundary lines. Each project was attributed to only one basin or zone.

There are limitations to regional analysis when comparing source water data to project water use data. Projects may be in two zones or basins, and the source water may not come from the same zone or basin where the project is located.

The major drainage basins in Alberta are the Milk River Basin, South Saskatchewan River Basin, North Saskatchewan River Basin, Athabasca River Basin, Peace River Basin, Slave River Basin, Churchill River (Beaver River) Basin, Hay River Basin, and Liard River Basin. The Milk, Hay, and Liard are relatively small basins with limited development. The Peace and Athabasca include both conventional and thermal projects, while the Churchill has thermal projects exclusively.

Figure 3: Alberta river basins

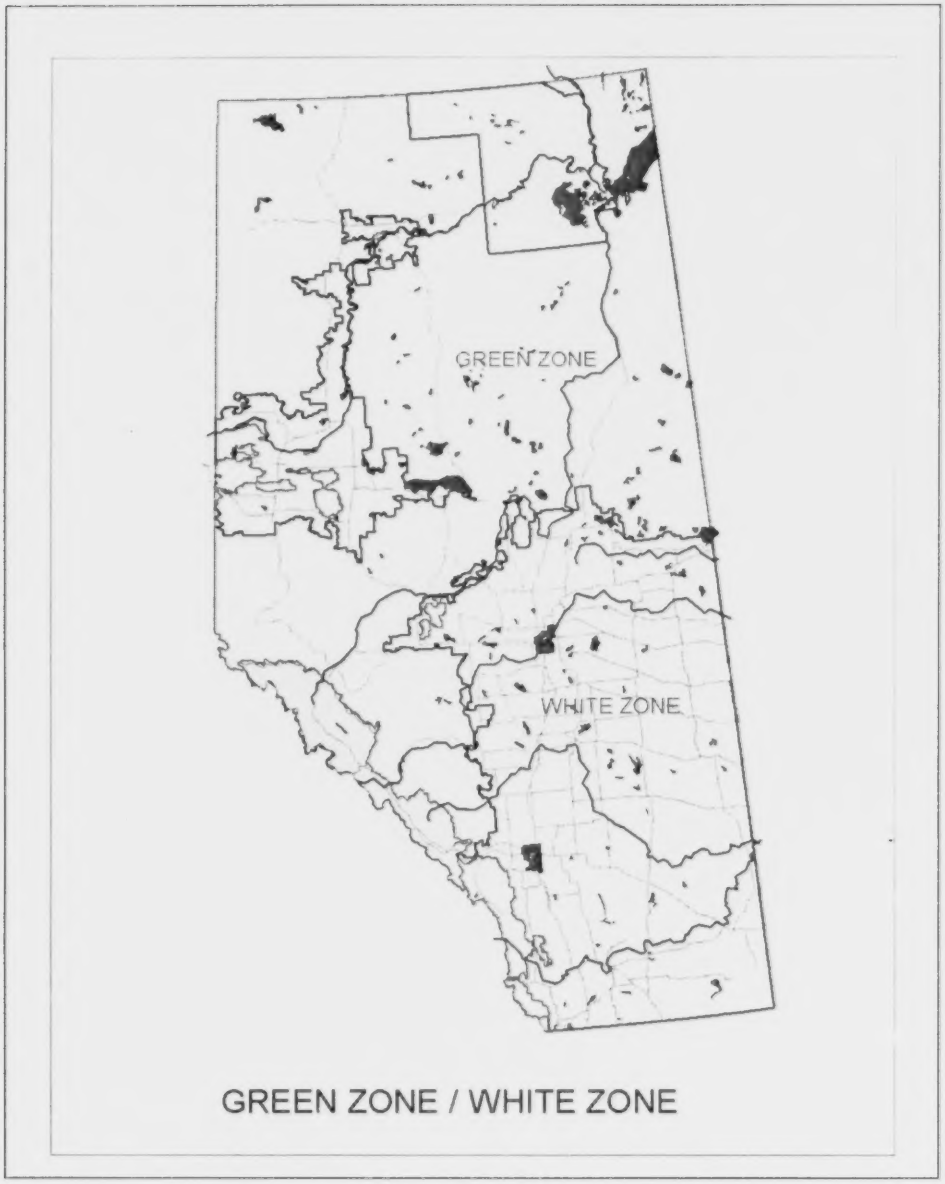

Figure 4: Green Zone and White Zone in Alberta

DATA CONSIDERATIONS

In a relational database it is desirable to "normalize" the tables in order to maintain referential integrity; however, in this review normalization of the data was minimized. This was done to keep the data as close as possible to its original format in case errors and/or problems were discovered. Also, if the data were to be used in the future, it would be desirable to redesign some of the tables. Maintaining the original data format is useful in completing such a task.

Retrieving data from the PID is complex and requires manual review. Future queries to capture additional information from the PID could be done using more general criteria with the resulting records being compared to the tables used in this study.

AENV data can be updated and augmented by re-running a query to select all injection projects and comparing the resulting records to the existing table. One concern, however, is that incorrect coding of approvals in EMS might create a new WA for an existing authorization when approvals are transferred or updated. A review of the data is required to ensure that this concern is addressed.

Spatial attributes such as zone and drainage basin were written into attribute fields to perform analysis. Because boundaries or the data defining them change, it is better to perform spatial analysis based on current boundary maps rather than writing a spatial classification into data fields. In this study, however, it was necessary to create fields because of the different types of software being used.

All of the wells from the EUB licensed table were classified as either saline or non-saline; however, due to time constraints, the method of classification varied. Currently active wells were classified based on their depth and or chemical analysis, which provides a fairly reliable method. Inactive wells were classified by depth and sometimes only proximity, which is an uncertain method (Figure 5).

Figure 5: Ground Water Classification

Many checks were performed to determine the accuracy and reliability of the data. In statement form, there appears to be reliable correlations for conventional EOR data. It is possible that some of the reported source water diverted is used for other purposes, in addition to injection. In some cases, the operators may not have any way of separating the data or may not understand the need to separate the data for regulatory review and tracking. This is probably not a major issue for conventional projects but could be significant for thermal projects. The water balances in this study, or detailed review of water balances for individual projects, may be useful in identification of some of these problems.

A process was developed to select groups of projects and water sources, sum their volumes, and display the data at the press of a button. Figure 6 shows a group of green boxes representing EOR projects, and red stars representing water sources, from a small area of the province, based on a GIS spatial analysis. For this grouping, the relationship between source water, injectant, and water produced was very similar to the relationships shown in the water balances for the entire province.

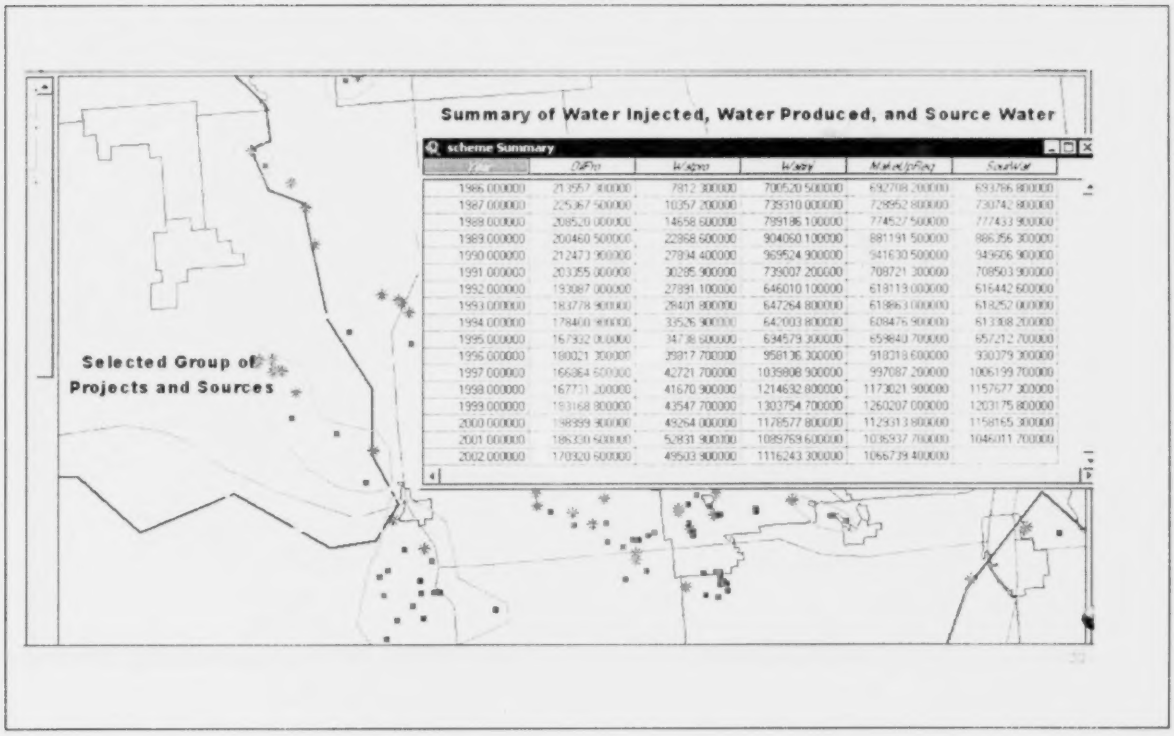

Figure 6: Data selection and comparison using GIS methods

Data gaps

A number of gaps in the data were identified in gathering the data for this report. It is respectfully submitted that the following improvements be considered:

- Chemical analysis of all source water wells could be obtained and recorded in a database.
- AENV administrators and source water operators could confirm links between AENV authorization records and EUB source water.
- Operators could be required to identify the projects where they use source water.
- Conventional production and disposal for a few years could be examined to see if reasonable balances can be created.

RESULTS

Source water

AENV licensed allocations of water for injection

When an authorization is issued under the *Water Act*, the authorization states an approved maximum annual quantity of water (the "allocation"). The total such allocation that may be diverted for injection purposes from surface and ground water sources has increased from 94.6 million m^3 in 1972 to 169 million m^3 in 2001 (Figure 7).

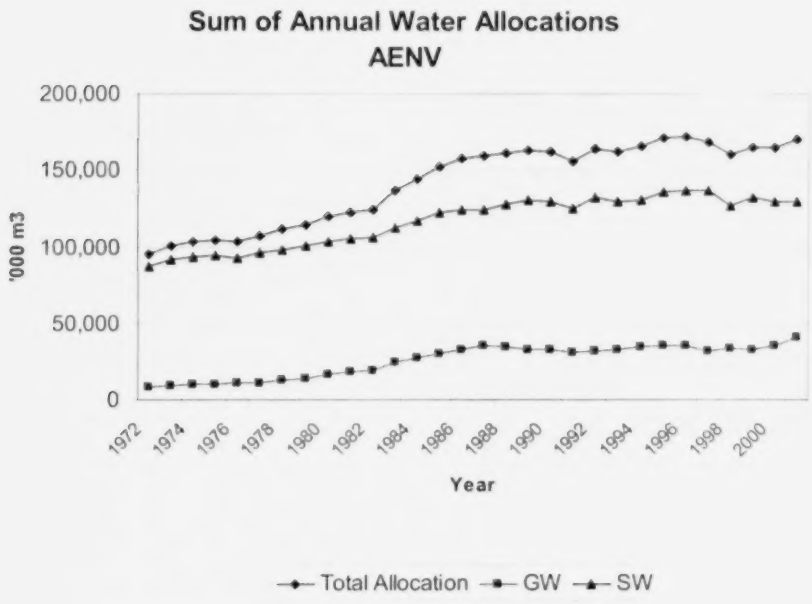

Figure 7: Sum of Annual water allocations issued by AENV for injection

Comparing AENV and EUB source water use reports

AENV water use licences for oilfield injection require industry tracking and submission when required of annual water use reports, which are similar to reports submitted to EUB. The number of water use reports received by AENV between 1972 and 2001 is less than those reported to the EUB each year (Figure 8).

Overall, the number of reports received by EUB should be greater than that received by AENV because EUB receives reports from saline uses that do not require approval from AENV. However, the number of AENV water use returns decreased substantially since 1995 while the number of EUB returns did not.

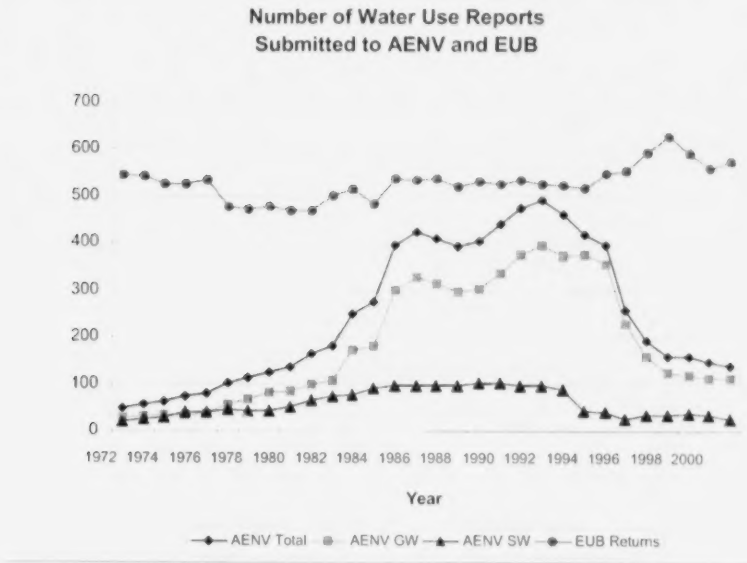

Figure 8: Number of Water Use Reports Submitted to AENV and EUB

Figure 9 shows a comparison of volumes reported to EUB and AENV. Analysis of the EUB and AENV data sets indicates that a good fit was achieved when comparing the data. However, the EUB data is considered a more complete record because of continuous reporting requirements; thus, it was used as the primary source of information for the following analyses.

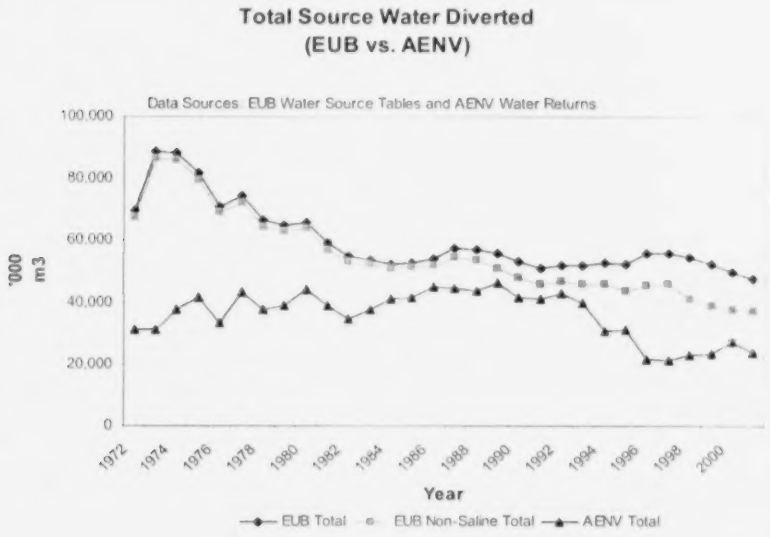

Figure 9: Total Source Water Diverted (EUB vs. AENV)

Volumes of source water used

The total volume of source water diverted for conventional and thermal projects has generally declined from a high of about 88 million m^3 in 1973 to a low of 47.5 million m^3 in 2001 (Figure 10). Most of that decline is for conventional EOR, while the use of source water for thermal projects is increasing. In 2001, approximately three-quarters of the volume of source water diverted was used in conventional projects (37.3 of the total 47.5 million m^3).

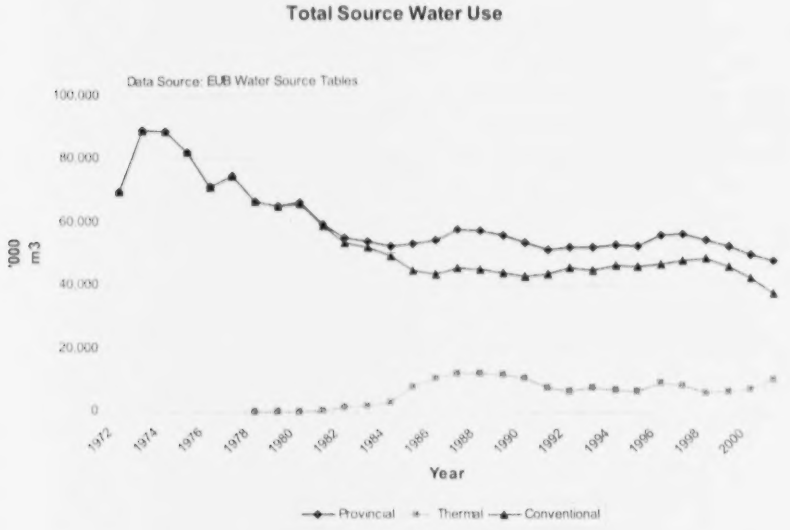

Figure 10: Total Source Water Use (conventional and thermal)

Distribution of source water use

The Athabasca River basin has experienced the most significant decline in source water use for injection. In other basins, the usage has remained relatively steady (Figure 11).

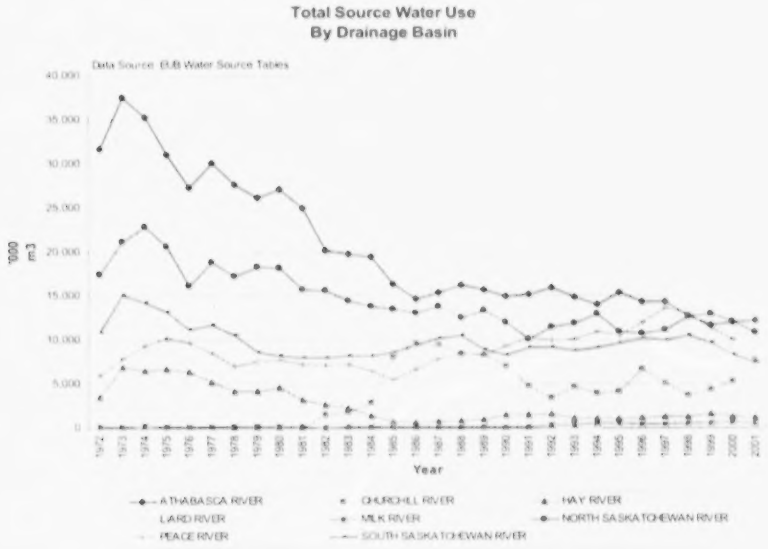

Figure 11: Total Source Water Use by Drainage Basin

Types of source water used

All the source water locations from the EUB PID spreadsheets for "shallow" wells were classified as non-saline ground water, and all water source locations in the lakes and rivers table were classified as surface sources. The EUB separated ground water sources into saline and non-saline categories based on detailed geological and geochemical criteria. Figure 12 shows the trends in surface, saline ground water, and non-saline ground water use on a provincial basis.

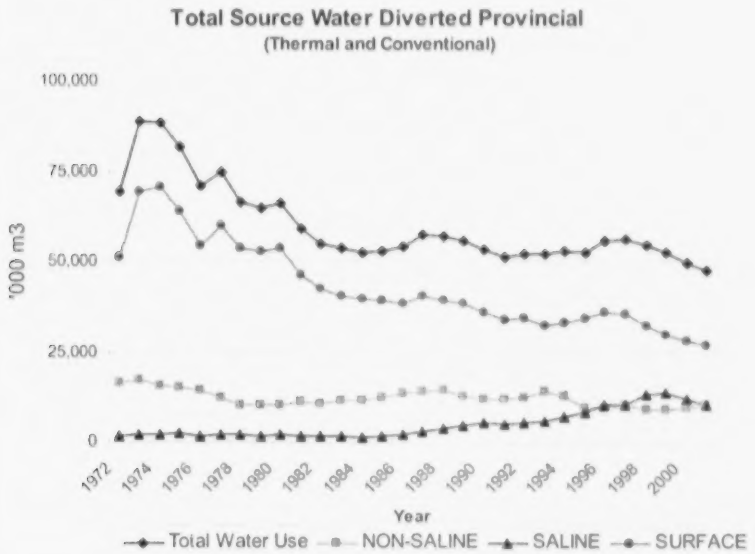

Figure 12: Total Source Water Diverted Provincial (thermal and conventional)

The 1990 "Ground Water Allocation Policy for Oilfield Injection Purposes" was developed to encourage the use of saline ground water in the White Zones. The use of saline water has increased since about 1984. The policy provides continued support on the use of saline water.

Total source water for the Green zone is shown in figure 8 in the Water Use for Injection Purposes in Alberta, Appendix: Figures and Tables

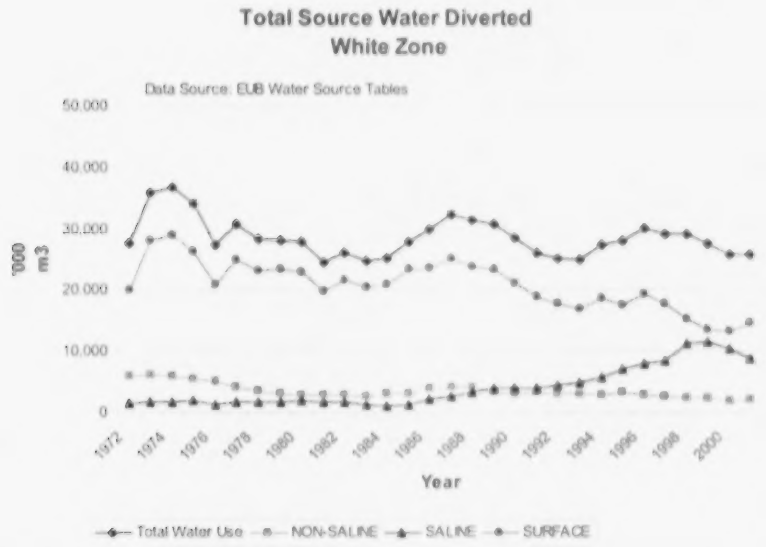

Figure 13: Total Source Water Diverted White Zone

Conventional projects

For any given year, the volume difference between the water injection volume curve and the water production volume curve approximates the source water volume curve, which may be the requirement to replace hydrocarbon production that would be made up of the oil production volume curve. While oil production from conventional EOR projects is declining, water injection and water production have increased due to increased recycle rates (Figure 14).

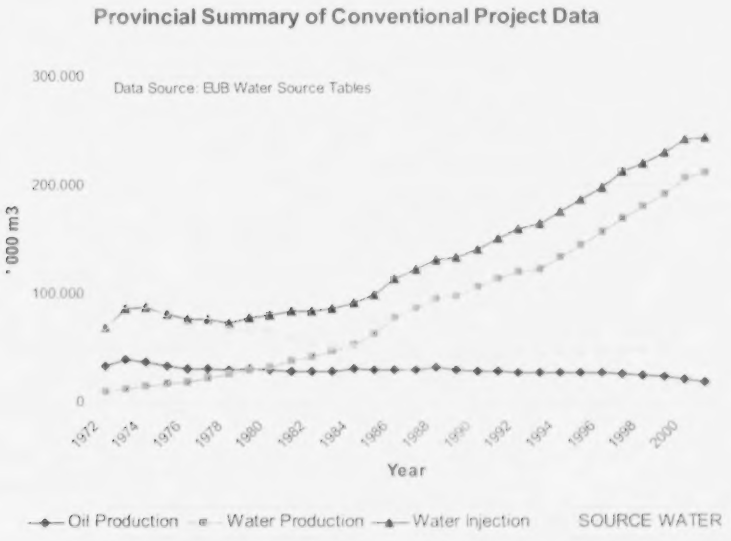

Figure 14: Provincial Summary of Conventional Project data

Thermal projects

Figure 15 shows increasing amounts of injectant used for steam injection, water produced, and bitumen produced for the thermal projects.

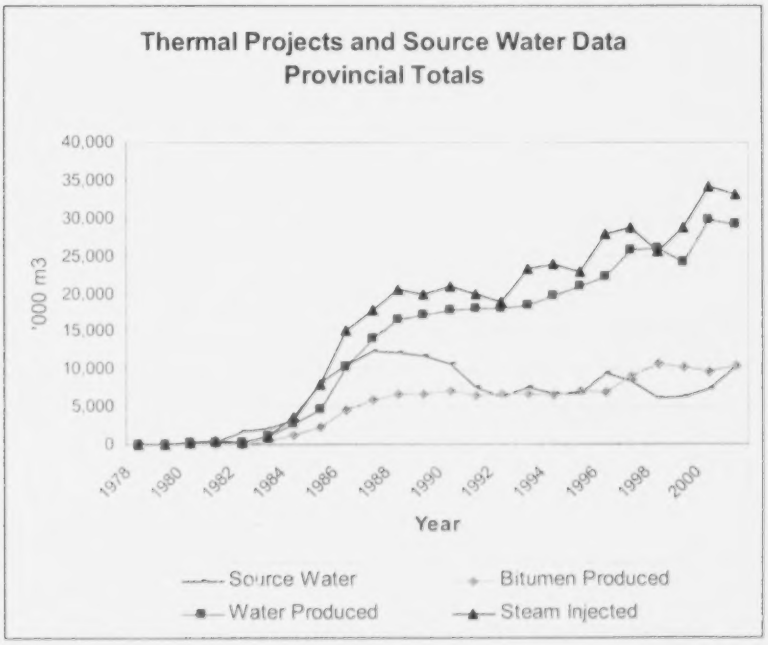

Figure 15: Thermal Projects and Source Water Data

Water balances

Conventional projects

Working with staff from Alberta Department of Energy, a series of water balances for conventional projects were prepared for the White and Green Zones and major river basins. The use of water balance relates source water data to project data.

The formula given for calculating water balances is as follows:

- Water recycle = Water Injection (from EUB project data) – Water source (from EUB source data)
- Water Disposal = Water Production – Water Recycle

- Recycle Rates = Water Recycle / Water Production

Water Balance figures 27 to 40 in the appendix show some quantities as negative values. These are simplified equations. Using this method results in some quantities with negative values. Reasons for discrepancies could include:

- Reservoir with gas cap;
- Reservoir not above bubble point;
- Reservoir not under voidage replacement control;
- Significant quantities of other material injected into reservoir (such as solvent or gas);
- Measurement errors;
- Transfer of fluids between projects; and
- Loss of injected materials to other zones.

A review on a project specific basis is required to provide detailed analysis.

The water balance (Figure 16) shows the declining trend in source water use as opposed to increased water injection and water production volumes. Using this broad method of considering water balance, water recycle rates have increased (see Figure 17).

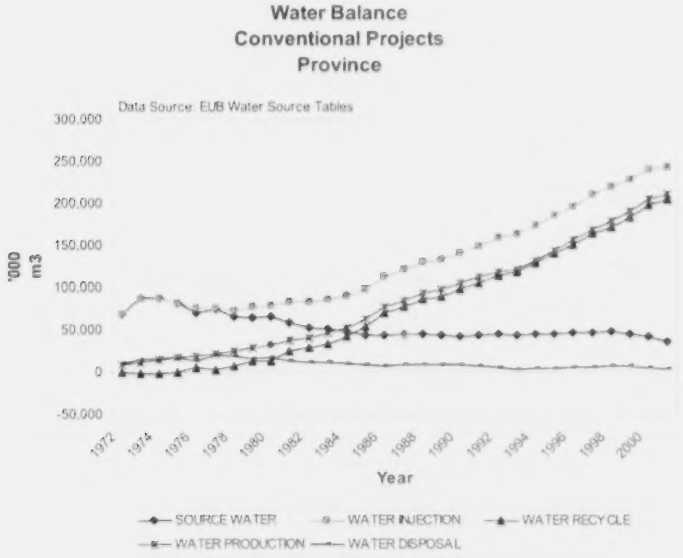

Figure 16: Water balance for conventional projects

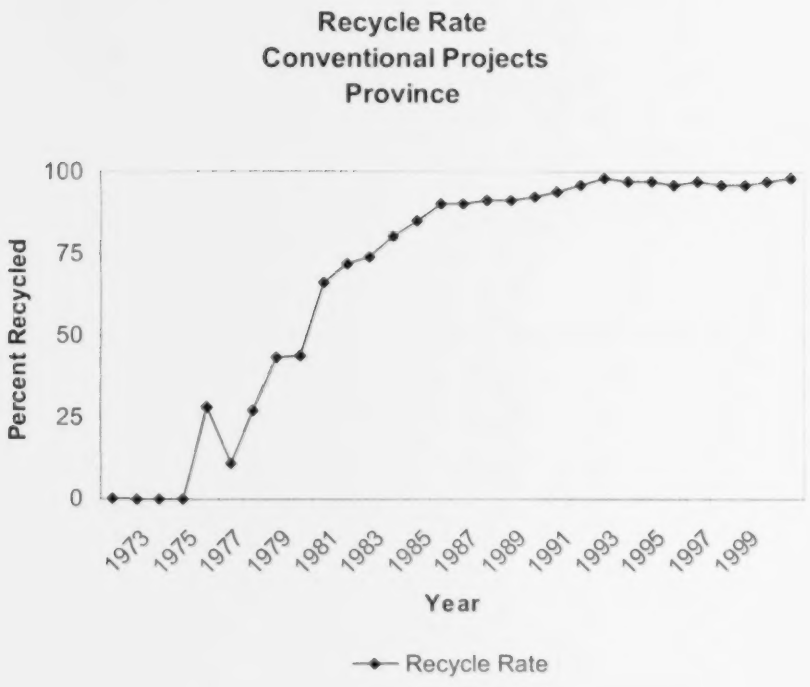

Figure 17: Recycle rate for conventional projects

Thermal projects

While water balances could be developed for conventional projects, there was insufficient data to prepare water balances for the thermal projects. Due to the limited data, conclusive trends for recycling water could not be developed.

CONCLUSIONS

Source water diversion for injection by the petroleum industry has been declining over the period of review from 1972 to 2001. The maximum volume of source water diverted was 88.7 million m^3 in 1973 and, by 2001, the volume had declined to 47.5 million m^3.

In 2001, more than one-quarter of all source water for injection (47.5 million m^3) was used for thermal projects (10.2 million m^3), with the remaining three-quarters (37.3 million m^3) used for conventional projects.

Trends in source water usage vary by drainage basin.

Use of saline water has been increasing and the amount of non-saline ground water used has declined. Saline water use has been increasing in the White Zone from 4 million m^3 in 1990 to 8.9 million m^3 in 2001.

The total volume of injectant for conventional reservoirs has increased steadily. In 2001, the volume of injectant was 243 million m^3 as compared to 69 million m^3 in 1973. Most of the injection volume is from produced water rather than source water. Volumes of steam injected and volumes of water produced from thermal projects have been increasing; however, significant variation exists between projects.

Water balances give an approximate indication of water recycling and water disposal volumes. These balances have relevance on a provincial basis for conventional schemes over recent years; however, they are less useful for specific conventional and thermal schemes and historical use, in part because produced water may be used from non-EOR projects and such water would not be recorded in the source water data. The water balances indicate that the recycling rates for conventional projects are increasing.

EUB's source water data is more complete than AENV's because EUB collects water used from all sources, including saline ground water wells.

GLOSSARY OF TERMS AND ABBREVIATIONS

AENV (Alberta Environment): The provincial department responsible for administering the *Water Act*.

Base of ground water protection: Usually defined as a formation name, the depth below which water is generally saline with a total dissolved solids (TDS) exceeding 4,000 mg/l. Aquifers above the base of ground water protection cannot be used as disposal zones and are protected by EUB and AENV regulations, and by industry drilling and casing practices, to safeguard usable water supplies.

Bubble point: The point at which small bubbles of gas begin to form inside the liquid, as pressure is reduced in an oil reservoir,

Cyclic (In-Situ Project): A term used to describe a type of thermal recovery process utilizing steam injection. Recovery of crude bitumen or heavy density oil by cyclic steam stimulation consists of intermittent slugs of steam in a wellbore that heat the area near the wellbore to reduce the heavy oil viscosity and allow drainage to begin. Injection and production of crude bitumen is through the same wellbore.

CSS (Cyclic Steam Stimulation): See above.

Disposal water: Produced water from all oil, gas, and crude bitumen production that is injected into an underground formation approved for disposal by the EUB, through EUB-approved disposal wells, as distinct from recycled produced water which is produced water that is re-injected into a producing oil pool in an EOR scheme approved by the EUB.

EMS (Environmental Management System): A comprehensive database of water licences developed and used by AENV.

EOR (Enhanced oil recovery): A process in which water (saline, non-saline, produced and recycled) is injected into oil reservoirs to increase the reservoir pressure so that more oil can be extracted. The two main types of EOR are water flooding, in which water is pumped into conventional oil field reservoirs, and injection of steam into heavy oil deposits.

EUB (Energy and Utilities Board): The EUB is a provincial quasi-judicial, independent body created by the Government of Alberta to ensure that the energy resources of the province are responsibly developed and that the natural monopoly around the transportation of these resources has reasonable tariffs. For instance, it is specifically mandated to ensure optimum recovery of the province's oil, gas, and crude bitumen resources.

Green Zone: The mainly public, forested lands of northern Alberta and the Eastern Slopes that were originally withdrawn from settlement.

Ground water: Water that is underground, filling voids or fractures in rocks, and the voids between grains of unconsolidated sediments.

Injectant: An EUB–approved fluid for injecting into an EOR project, Thermal project or disposal well; the fluid type may be water, wastewater, solvent, steam, gas, etc.

Injection: Either water flooding or steam injection.

Licensed wells: Deep, generally saline wells that are licensed by the EUB (all wells greater than 150 m deep are licensed by the EUB.)

Make-up water use: Water that is not recycled produced water, which is injected into an oil-bearing zone to enhance the operation of an EOR project. Make-up water is needed to replace the volume of oil and gas produced in conventional hydrocarbon EOR projects, and replace volumes of produced water that are lost in the treatment and steam generation processes for thermal in-situ projects (oil or crude bitumen).

Non-saline water: Water with less than 4000 mg/L of total dissolved solids (TDS).

Oilfield injection: Processes in which water, with or without another injectant (hydrocarbon solvent or CO_2), is injected through wells into conventional hydrocarbon reservoirs to increase or maintain the reservoir pressure so that hydrocarbon recovery is increased. Oilfield injection also includes processes in which water is injected as steam through well(s) into oil sands deposits or conventional heavy oil pools to lower the viscosity of the crude bitumen so that it can flow to a production wellbore.

PID (Production Injection Database): An EUB database that includes oil, gas and water production volumes, water injection and water disposal wells. It also includes water production volumes for licensed (saline and non-saline) wells and surface and shallow locations.

Priority number: A number assigned by AENV, through EMS, to specific allotments of water granted in a *Water Act* licence. Separate Priority numbers may exist for individual water wells on a ground water licence. Multiple licences with different priority numbers may be granted for a single water diversion project, depending on specific locations and withdrawal criteria of the project. The priority number is based on the date an application is received from the applicant and indicates the priority for use of the water, relative to other licensed users.

Processing water: Water that is used in the upstream petroleum industry for purposes other than EOR or thermal recovery.

Produced water: Water that is produced along with hydrocarbons (oil, gas, and crude bitumen) from a well. Produced water is separated from the oil and gas and is measured and reported to the EUB. Produced

water volumes from every oil and gas production well are included in the EUB PID database.

Project: An EUB-approved production and injection project operated by one operator.

Recycled water: The total quantity of water injected at a project less the source water.

SAGD: (Steam-Assisted Gravity Drainage): A term used to describe a type of thermal recovery process used for the in-situ recovery of bitumen from oil sands. The process consists of continuous injection of steam into the oil sands through a horizontal injector well, which lowers the viscosity of crude bitumen enough that it drains into a lower production wellbore. The process requires precisely aligned horizontal well-pairs with the injector well drilled 5 to 10 m above the production well.

Saline ground water: Ground water that has more than 4000 mg/L of total dissolved solids (TDS).

Shallow wells: Wells that are less than 150 m deep. They are generally non-saline and thus may be licensed by AENV as ground water sources; the EUB does not license shallow wells but does compile the monthly volumes of water that are injected into EOR projects from shallow source wells.

Source water: Water that is diverted from surface and ground water sources for injection use in enhanced oil recovery projects.

Startup water: The large initial water volume required for injection to a new conventional EOR project to replace voidage created during primary removal of oil and gas. The large volumes of water needed at steam plants to initiate thermal recovery of bitumen are also referred to as startup water. The ongoing requirements for make-up water in conventional and thermal EOR projects are usually at lower rates than are needed during startup of the project.

Steam injection: A process in which steam is injected into oil sand deposits to reduce the bitumen viscosity to allow it to flow in the reservoir and be produced to surface. (The heat reduces the bitumen viscosity to allow it to flow.)

Surface water: Flowing and still water on the land surface (i.e., lakes and rivers).

Upstream petroleum industry: The exploration, development, and production end of oil and gas development. Does not include pipelines or "downstream" facilities such as refineries.

WA (Water Allocation) number: A unique number assigned by AENV, through EMS, to specific allotments of water usage throughout Alberta. Several WAs may exist for a particular water licence, depending on specific locations and withdrawal criteria.

Water flooding: A term used to describe an EOR process in which water is pumped down EUB-approved injection wells to maintain the reservoir pressure so that hydrocarbon recovery is enhanced. Water flooding is the process used in conventional oilfield injection, when water is the main injection fluid.

Water use returns: Required reports from licensed water users to AENV that show how much water they used under given licences (usually reported annually).

White Zone: The settled regions where agriculture is the most significant land use, including the grasslands and parklands of southern and central regions, and the Peace Country in the north.

Water Use for Injection Purposes in Alberta

Appendix: Figures and Tables

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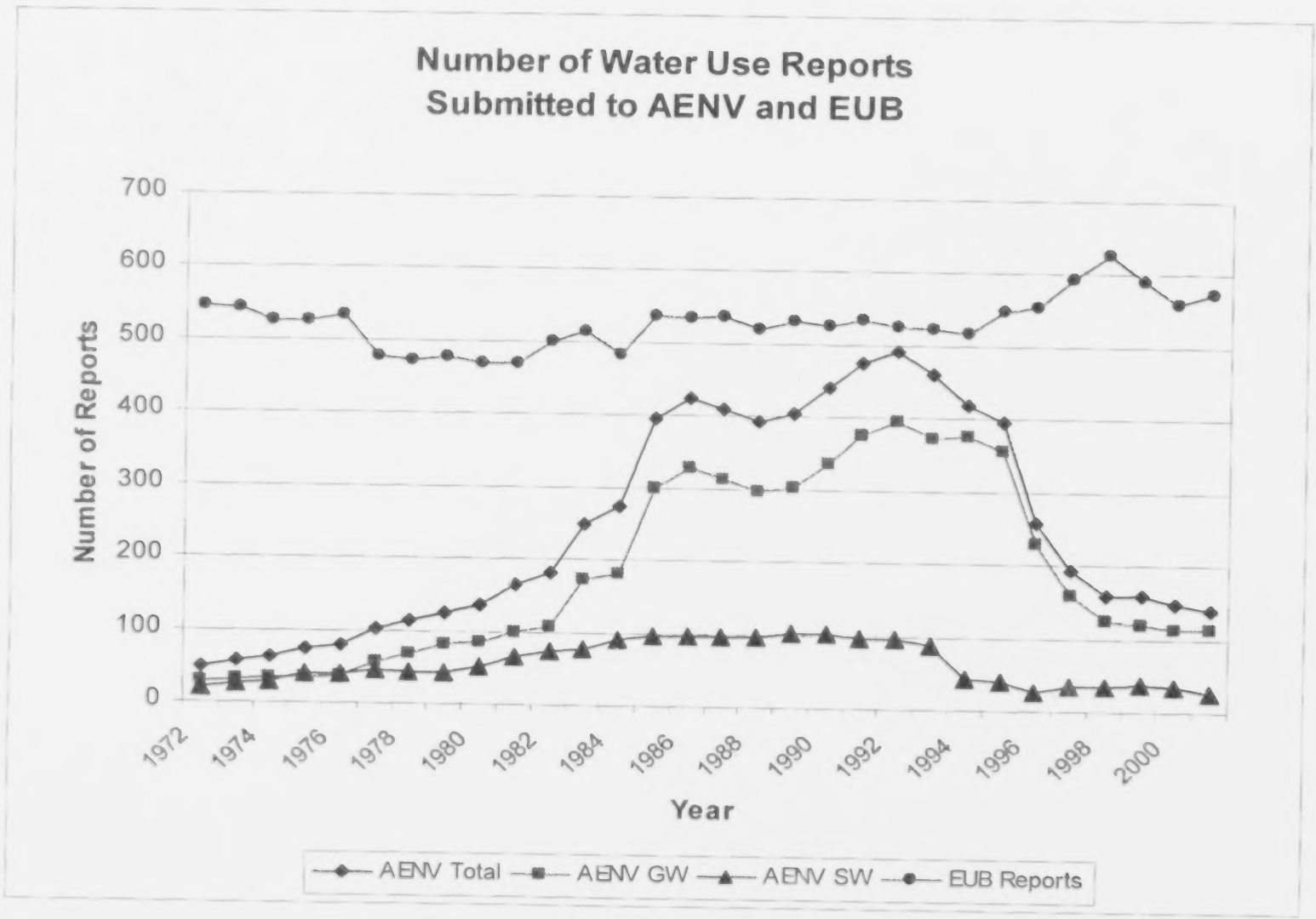

Table 1: Number of Water Use Reports submitted to AENV and EUB

Year	AENV Total	AENV GW	AENV SW	EUB Reports
1972	49	29	20	544
1973	56	32	24	541
1974	61	33	28	526
1975	74	34	40	526
1976	78	38	40	534
1977	102	57	45	477
1978	112	69	43	471
1979	125	82	43	476
1980	136	84	52	468
1981	163	99	64	468
1982	180	107	73	500
1983	249	172	77	513
1984	273	182	91	483
1985	395	299	96	535
1986	424	327	97	534
1987	408	313	95	535
1988	392	296	96	519
1989	404	302	102	532
1990	439	337	102	526
1991	473	376	97	533
1992	491	394	97	524
1993	461	373	88	522
1994	417	375	42	517
1995	396	356	40	547
1996	256	230	26	554
1997	193	158	35	592
1998	158	124	34	628
1999	157	119	38	590
2000	146	113	33	558
2001	137	112	25	573

Figure 2a: Total Source Water Diverted, Conventional and Thermal Combined (m^3)

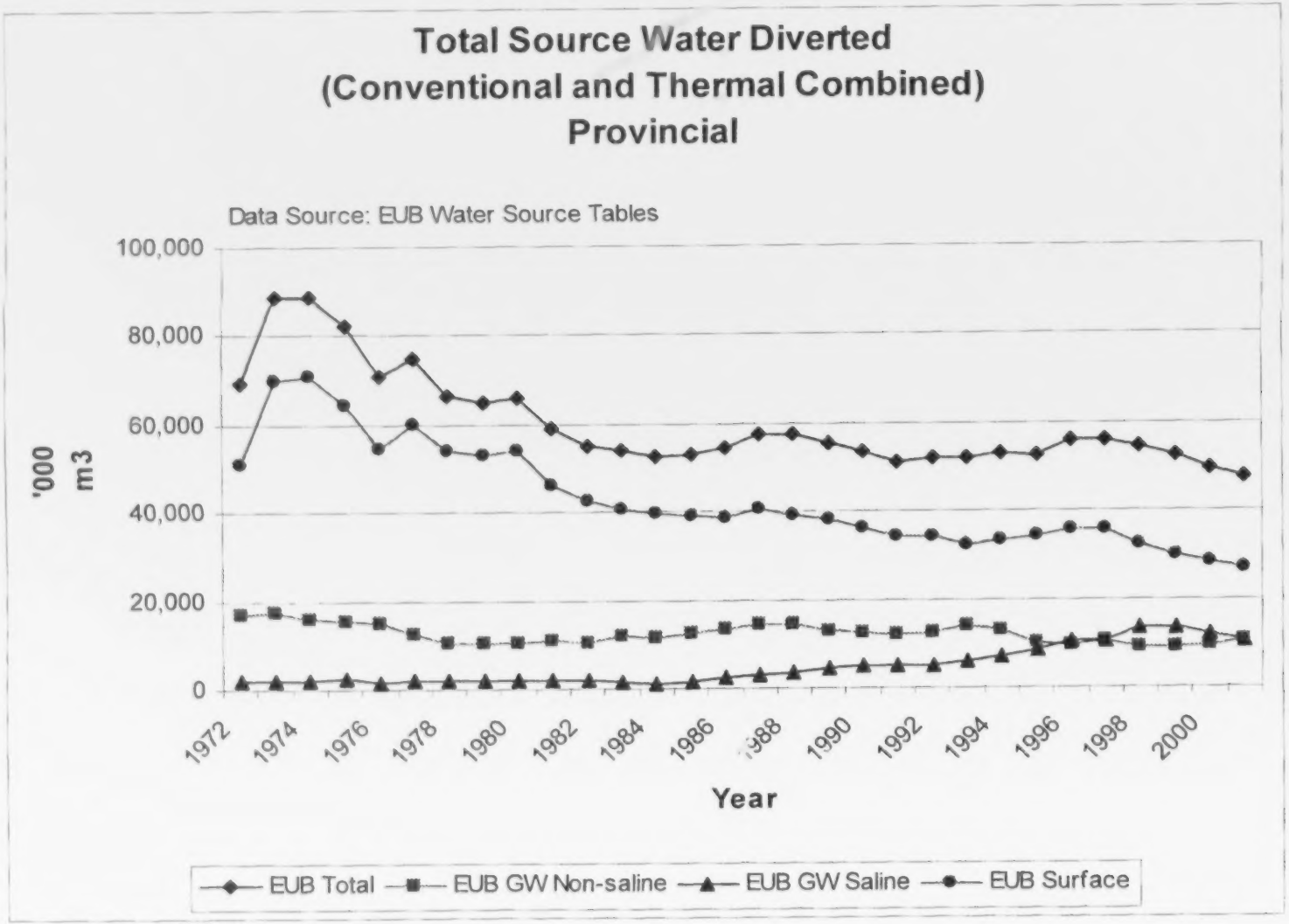

Figure 2b: Total Source Water Diverted, Conv. & Thermal—EUB vs AENV (m^3)

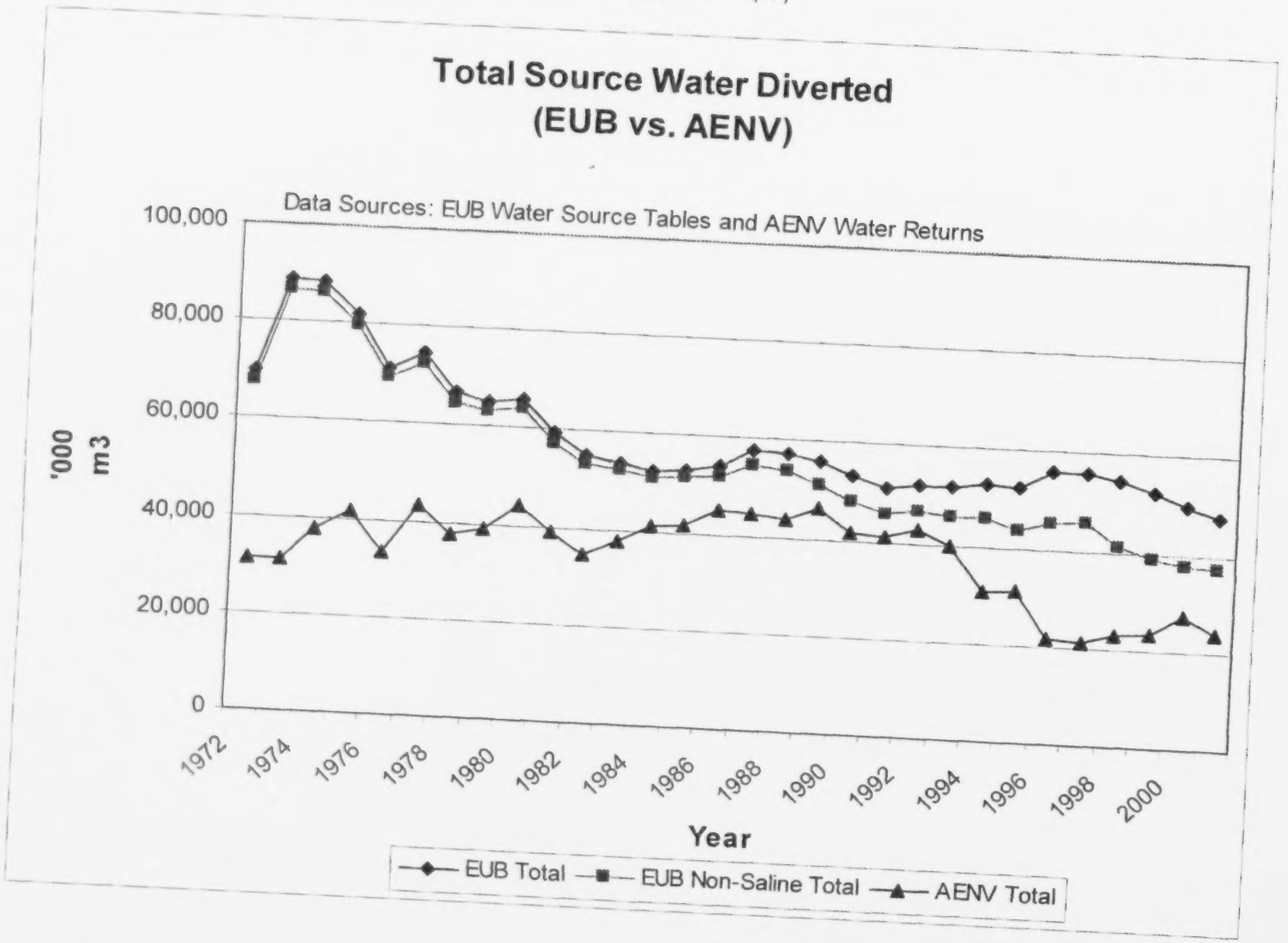

Table 2: Total Source Water Diverted Conv. & Thermal EUB and AENV (m^3)

Year	EUB Total	EUB GW Non-saline	EUB GW Saline	EUB Surface	EUB Non-Saline Total	AENV Total
1972	69,497,060	16,671,280	1,762,711	51,063,068	67,734,349	31,075,594
1973	88,760,866	17,180,840	2,004,389	69,575,638	86,756,478	31,313,597
1974	88,445,795	15,703,644	2,103,649	70,638,501	86,342,145	37,510,614
1975	81,957,696	15,297,300	2,508,997	64,151,399	79,448,699	41,757,990
1976	70,914,481	14,634,111	1,625,407	54,654,963	69,289,074	33,508,607
1977	74,589,665	12,509,086	2,097,720	59,982,860	72,491,945	43,317,836
1978	66,570,914	10,508,059	2,227,512	53,835,343	64,343,402	37,666,194
1979	64,927,542	10,330,523	1,834,898	52,762,121	63,092,644	38,764,974
1980	66,002,338	10,188,218	2,048,375	53,765,745	63,953,963	43,958,623
1981	59,134,161	11,019,623	1,841,987	46,272,551	57,292,174	39,080,780
1982	55,100,832	10,600,968	1,827,471	42,672,392	53,273,360	34,578,462
1983	53,817,732	11,643,709	1,541,752	40,632,271	52,275,979	37,822,864
1984	52,333,347	11,554,978	1,221,709	39,556,660	51,111,637	41,037,322
1985	52,969,977	12,366,511	1,510,992	39,092,474	51,458,985	41,348,335
1986	54,230,308	13,462,011	2,248,115	38,520,183	51,982,193	44,932,714
1987	57,591,467	14,187,014	2,969,379	40,435,073	54,622,087	44,706,531
1988	57,178,472	14,317,857	3,588,312	39,272,304	53,590,160	43,890,255
1989	55,680,630	12,869,420	4,560,012	38,251,198	51,120,618	46,155,060
1990	53,382,267	12,158,258	5,187,512	36,036,497	48,194,755	41,491,175
1991	51,142,187	12,054,653	5,077,549	34,009,984	46,064,637	41,023,653
1992	51,896,993	12,453,755	5,196,701	34,246,537	46,700,292	43,036,859
1993	51,974,216	13,906,141	5,906,020	32,162,055	46,068,196	39,869,785
1994	52,726,620	12,702,287	6,959,148	33,065,185	45,767,472	30,930,601
1995	52,288,569	9,698,103	8,388,711	34,201,755	43,899,859	31,039,088
1996	55,715,065	9,551,368	10,282,924	35,880,772	45,432,141	21,673,615
1997	56,036,714	10,199,530	10,297,236	35,539,948	45,739,478	21,395,602
1998	54,365,122	8,951,447	13,220,992	32,192,683	41,144,130	22,808,853
1999	52,299,540	9,104,218	13,521,459	29,673,863	38,778,081	23,191,344
2000	49,645,811	9,648,497	11,988,890	28,008,425	37,656,921	27,421,414
2001	47,525,748	10,157,259	10,424,625	26,943,864	37,101,123	23,848,393

Figure 3: Total Source Water Use (m^3)

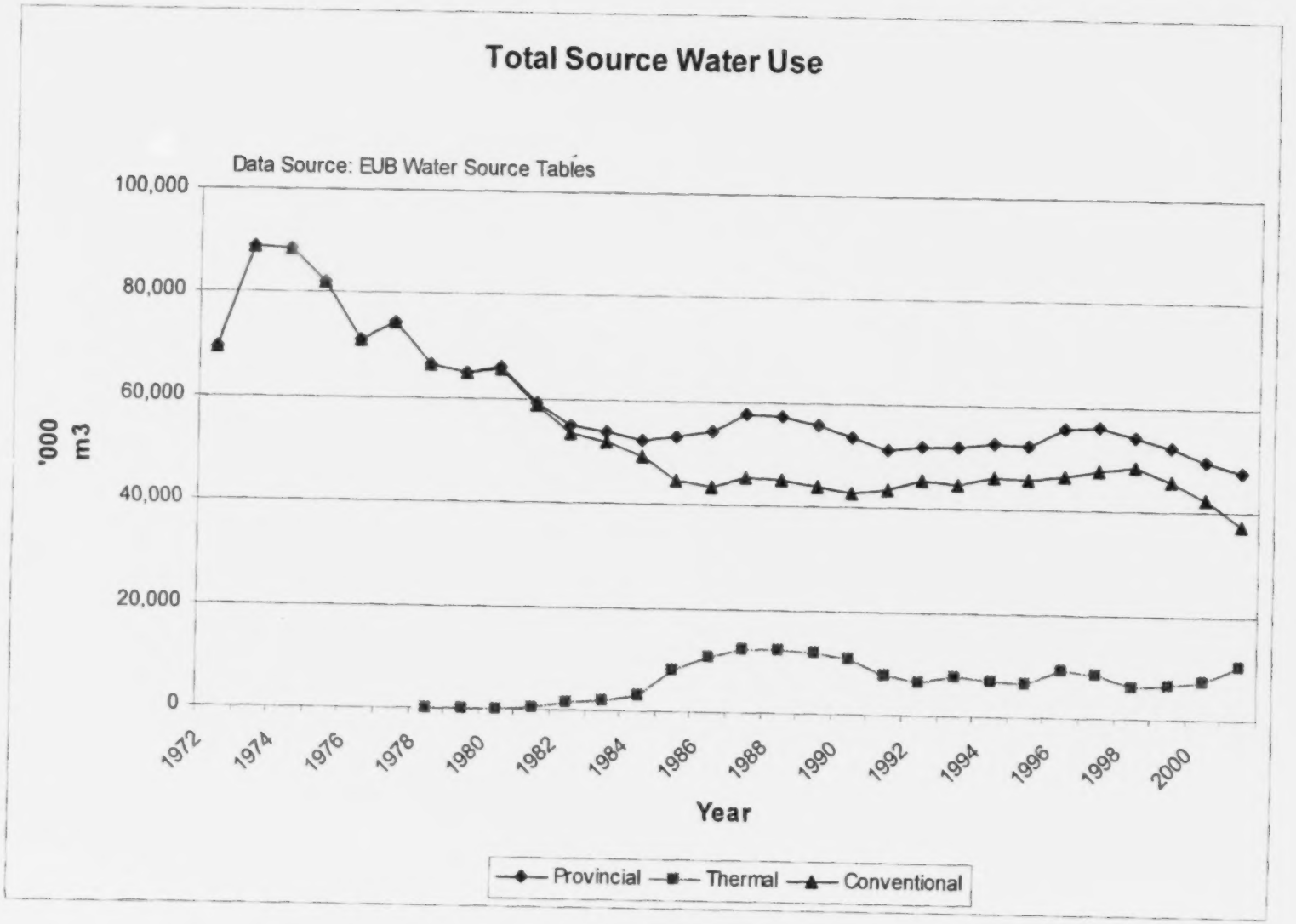

Table 3: Total Source Water Use (m^3)

Year	Provincial	Thermal	Conventional
1972	69,497,060		69,497,060
1973	88,760,866		88,760,866
1974	88,445,795		88,445,795
1975	81,957,696		81,957,696
1976	70,914,481		70,914,481
1977	74,589,665		74,589,665
1978	66,570,914	7,520	66,563,394
1979	64,927,542	31,768	64,895,774
1980	66,002,338	184,318	65,818,020
1981	59,134,161	241,098	58,893,063
1982	55,100,832	1,646,814	53,454,017
1983	53,817,732	2,071,889	51,745,842
1984	52,333,347	3,242,211	49,091,135
1985	52,969,977	8,204,679	44,765,298
1986	54,230,308	10,572,638	43,657,670
1987	57,591,467	12,340,050	45,251,417
1988	57,178,472	12,237,459	44,941,013
1989	55,680,630	11,786,336	43,894,294
1990	53,382,267	10,756,378	42,625,889
1991	51,142,187	7,602,709	43,539,478
1992	51,896,993	6,300,482	45,596,512
1993	51,974,216	7,469,764	44,504,452
1994	52,726,620	6,721,779	46,004,842
1995	52,288,569	6,616,995	45,671,574
1996	55,715,065	9,334,398	46,380,667
1997	56,036,714	8,447,305	47,589,408
1998	54,365,122	6,053,784	48,311,338
1999	52,299,540	6,316,675	45,982,865
2000	49,645,811	7,241,515	42,404,296
2001	47,525,748	10,233,436	37,292,312

Figure 4: Source Water Diverted for Conventional Projects Provincial Total (m^3)

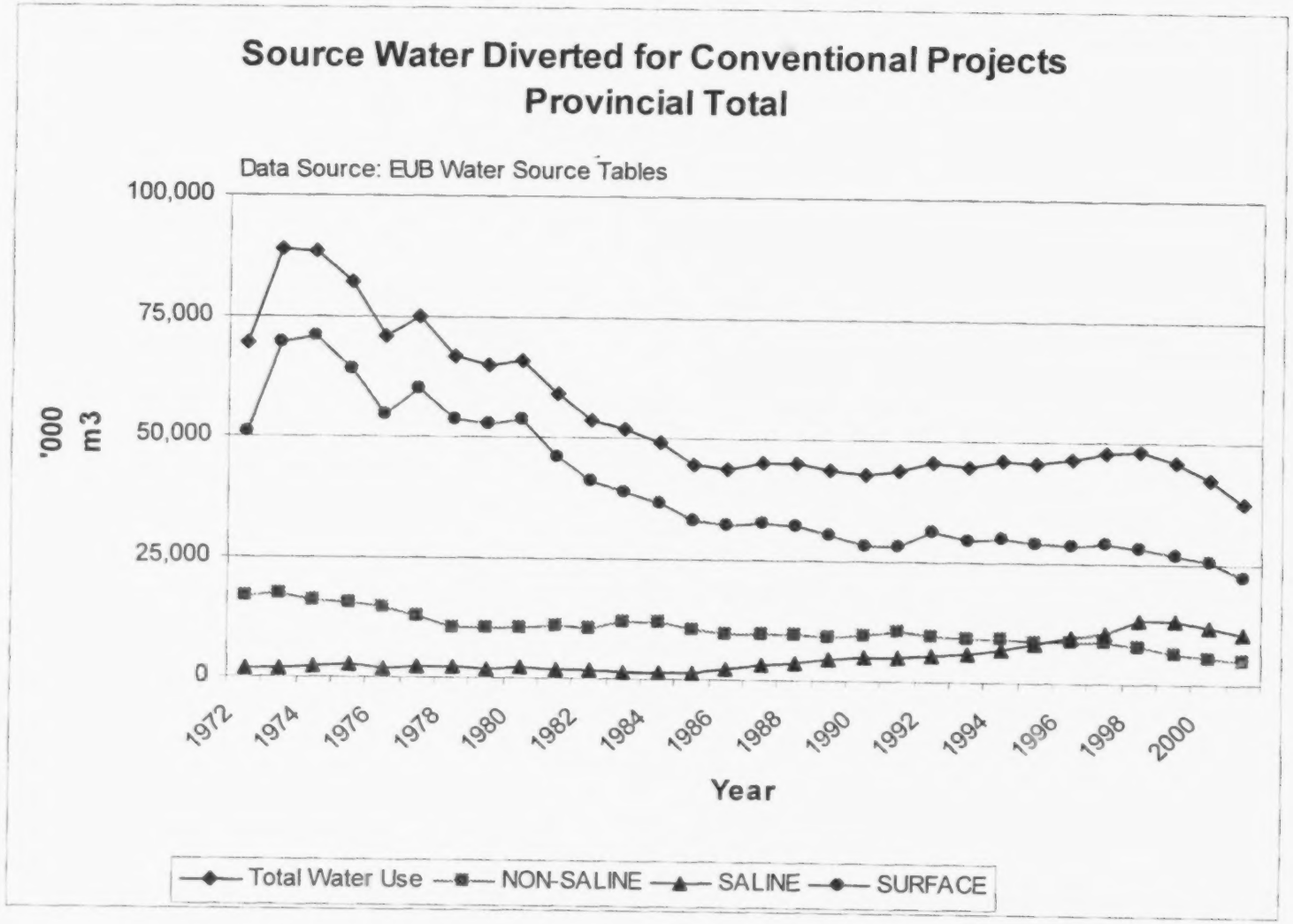

Table 4: Source Water Diverted for Conventional Projects Provincial Total (m^3)

YEAR	Total Water Use	NON-SALINE	SALINE	SURFACE
1972	69,497,060	16,671,280	1,762,711	51,063,068
1973	88,760,866	17,180,840	2,004,389	69,575,638
1974	88,445,795	15,703,644	2,103,649	70,638,501
1975	81,957,696	15,297,300	2,508,997	64,151,399
1976	70,914,481	14,634,111	1,625,407	54,654,963
1977	74,589,665	12,509,086	2,097,720	59,982,860
1978	66,563,394	10,507,552	2,227,512	53,828,330
1979	64,895,774	10,327,510	1,834,898	52,733,366
1980	65,818,020	10,185,909	2,048,375	53,583,736
1981	58,893,063	11,015,598	1,841,987	46,035,479
1982	53,454,017	10,585,422	1,827,471	41,041,124
1983	51,745,842	11,614,280	1,541,752	38,589,810
1984	49,091,135	11,519,714	1,221,709	36,349,712
1985	44,765,298	10,162,219	1,510,992	33,092,087
1986	43,657,670	9,604,758	2,248,115	31,804,798
1987	45,251,417	9,671,119	2,969,379	32,610,918
1988	44,941,013	9,427,686	3,588,312	31,925,015
1989	43,894,294	9,040,246	4,542,301	30,311,746
1990	42,625,889	9,476,158	5,151,324	27,998,407
1991	43,539,478	10,434,480	5,064,592	28,040,406
1992	45,596,512	9,538,405	5,196,701	30,861,405
1993	44,504,452	9,211,862	5,906,020	29,386,570
1994	46,004,842	9,096,756	6,959,148	29,948,938
1995	45,671,574	8,525,260	8,176,150	28,970,164
1996	46,380,667	8,683,698	9,269,464	28,427,505
1997	47,589,408	8,336,646	10,253,866	28,998,897
1998	48,311,338	7,486,603	12,873,084	27,951,652
1999	45,982,865	6,447,486	12,892,898	26,642,482
2000	42,404,296	5,236,600	11,846,281	25,321,415
2001	37,292,312	5,052,703	10,281,041	21,958,569

Figure 5: Source Water Diverted for Thermal Projects Provincial Total (m^3)

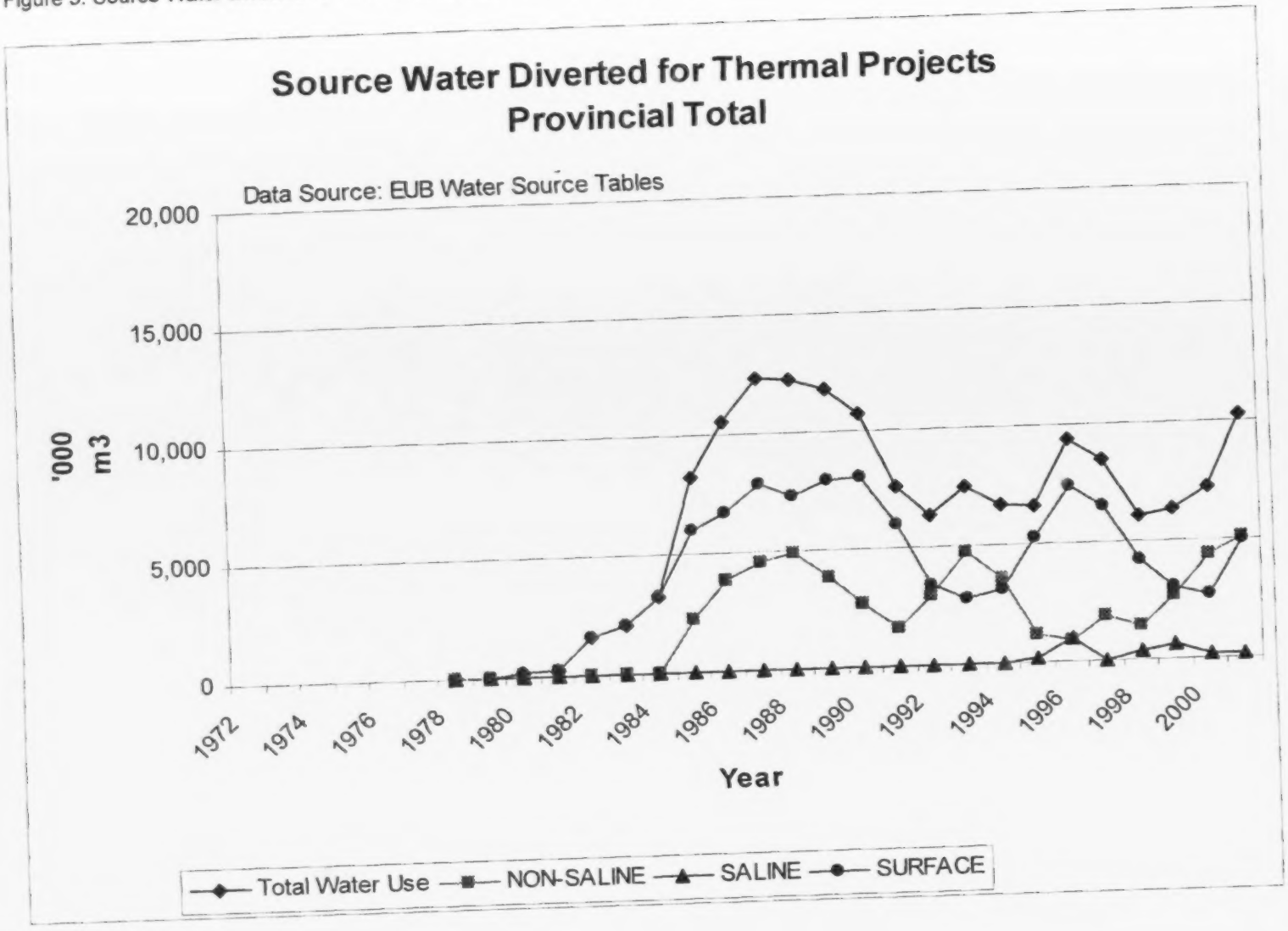

Table 5: Source Water Diverted for Thermal Projects Provincial Total (m^3)

YEAR	Total Water Use	NON-SALINE	SALINE	SURFACE
1972				
1973				
1974				
1975				
1976				
1977				
1978	7,520	507	0	7,013
1979	31,768	3,013	0	28,755
1980	184,318	2,309	0	182,009
1981	241,098	4,025	0	237,072
1982	1,646,814	15,546	0	1,631,269
1983	2,071,889	29,428	0	2,042,461
1984	3,242,211	35,263	0	3,206,948
1985	8,204,679	2,204,292	0	6,000,387
1986	10,572,638	3,857,253	0	6,715,384
1987	12,340,050	4,515,895	0	7,824,155
1988	12,237,459	4,890,171	0	7,347,289
1989	11,786,336	3,829,174	17,711	7,939,452
1990	10,756,378	2,682,100	36,188	8,038,090
1991	7,602,709	1,620,174	12,958	5,969,578
1992	6,300,482	2,915,350	0	3,385,132
1993	7,469,764	4,694,279	0	2,775,485
1994	6,721,779	3,605,532	0	3,116,247
1995	6,616,995	1,172,844	212,560	5,231,591
1996	9,334,398	867,670	1,013,461	7,453,267
1997	8,447,305	1,862,884	43,370	6,541,051
1998	6,053,784	1,464,845	347,908	4,241,031
1999	6,316,675	2,656,732	628,561	3,031,381
2000	7,241,515	4,411,897	142,609	2,687,010
2001	10,233,436	5,104,556	143,584	4,985,295

Figure 6: Total Source Water Diverted White Zone (m^3)

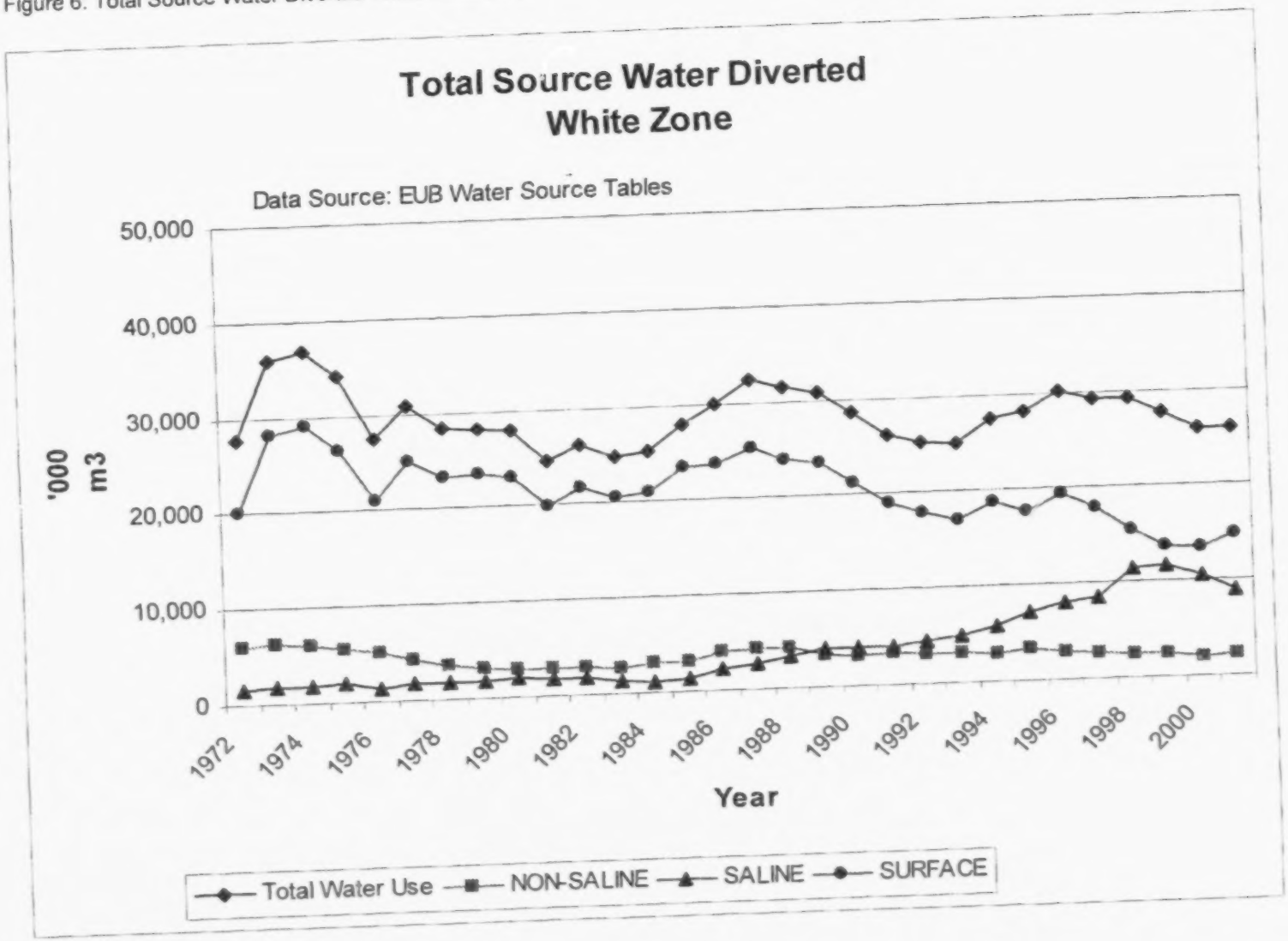

Table 6: Total Source Water Diverted White Zone (m^3)

YEAR	Total Water Use	NON-SALINE	SALINE	SURFACE
1972	27,641,521	6,099,742	1,505,095	20,036,684
1973	35,951,113	6,175,000	1,705,777	28,070,336
1974	36,867,401	6,014,446	1,763,103	29,089,852
1975	34,101,059	5,626,011	2,075,369	26,399,679
1976	27,431,260	5,195,127	1,240,102	20,996,031
1977	30,826,520	4,159,680	1,748,227	24,918,613
1978	28,406,254	3,463,525	1,827,766	23,114,964
1979	28,119,398	3,016,468	1,709,723	23,393,206
1980	27,938,087	2,931,635	1,941,249	23,065,204
1981	24,500,487	2,966,856	1,727,435	19,806,195
1982	26,117,712	2,818,496	1,733,597	21,565,619
1983	24,845,495	2,773,869	1,429,471	20,642,156
1984	25,286,335	3,068,847	1,149,052	21,068,436
1985	27,935,814	3,022,797	1,382,579	23,530,439
1986	29,869,846	4,050,250	2,140,181	23,679,415
1987	32,263,488	4,351,988	2,744,469	25,167,031
1988	31,540,280	4,265,627	3,357,029	23,917,625
1989	30,795,663	3,262,006	4,069,084	23,464,573
1990	28,483,460	3,152,722	4,051,526	21,279,212
1991	26,158,164	3,269,587	3,926,120	18,962,457
1992	25,248,282	3,047,418	4,386,451	17,814,413
1993	25,019,338	3,081,306	4,902,685	17,035,346
1994	27,520,621	2,999,613	5,772,868	18,748,140
1995	28,187,192	3,369,858	7,103,129	17,714,205
1996	30,126,077	2,796,738	7,972,092	19,357,247
1997	29,185,142	2,751,828	8,564,654	17,868,659
1998	29,173,067	2,388,163	11,452,384	15,332,521
1999	27,742,728	2,462,159	11,605,511	13,675,058
2000	25,872,985	2,055,708	10,453,437	13,363,839
2001	25,845,578	2,144,608	8,948,309	14,752,662

Figure 7: Source Water Diverted for Conventional Use White Zone (m^3)

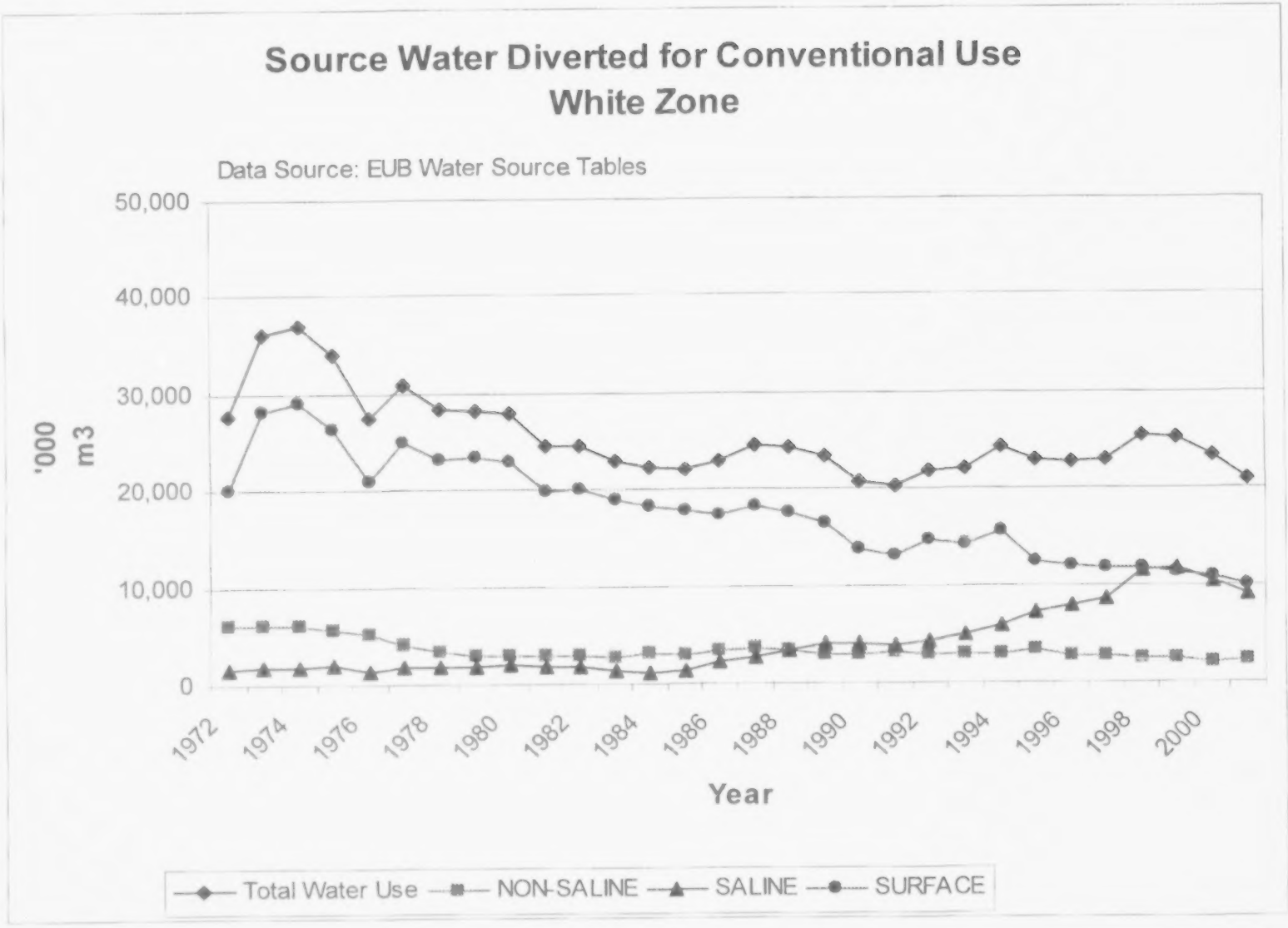

Table 7: Source Water Diverted for Conventional Use White Zone (m^3)

YEAR	Total Water Use	NON-SALINE	SALINE	SURFACE
1972	27,641,521	6,099,742	1,505,095	20,036,684
1973	35,951,113	6,175,000	1,705,777	28,070,336
1974	36,867,401	6,014,446	1,763,103	29,089,852
1975	34,101,059	5,626,011	2,075,369	26,399,679
1976	27,431,260	5,195,127	1,240,102	20,996,031
1977	30,826,520	4,159,680	1,748,227	24,918,613
1978	28,399,241	3,463,525	1,827,766	23,107,950
1979	28,094,631	3,016,468	1,709,723	23,368,440
1980	27,937,399	2,931,635	1,941,249	23,064,515
1981	24,476,296	2,964,771	1,727,435	19,784,090
1982	24,625,371	2,817,904	1,733,597	20,073,869
1983	23,034,111	2,770,489	1,429,471	18,834,151
1984	22,395,608	3,067,082	1,149,052	18,179,474
1985	22,097,251	3,018,496	1,382,579	17,696,176
1986	22,885,700	3,416,265	2,140,181	17,329,254
1987	24,535,493	3,585,061	2,744,469	18,205,963
1988	24,365,512	3,378,281	3,357,029	17,630,202
1989	23,352,624	2,961,474	4,051,373	16,339,777
1990	20,797,569	3,003,686	4,015,338	13,778,544
1991	20,187,039	3,139,485	3,913,162	13,134,392
1992	21,856,888	2,910,461	4,386,451	14,559,976
1993	22,118,112	2,941,588	4,902,685	14,273,839
1994	24,293,753	2,888,992	5,772,868	15,631,893
1995	22,863,457	3,277,714	7,103,129	12,482,613
1996	22,716,428	2,787,946	7,972,092	11,956,390
1997	23,063,191	2,751,828	8,564,654	11,746,709
1998	25,532,240	2,388,163	11,452,384	11,691,693
1999	25,279,024	2,462,159	11,605,511	11,211,354
2000	23,336,400	2,055,708	10,453,437	10,827,254
2001	21,049,097	2,144,608	8,948,309	9,956,181

Figure 8: Total Source Water Diverted Green Zone (m^3)

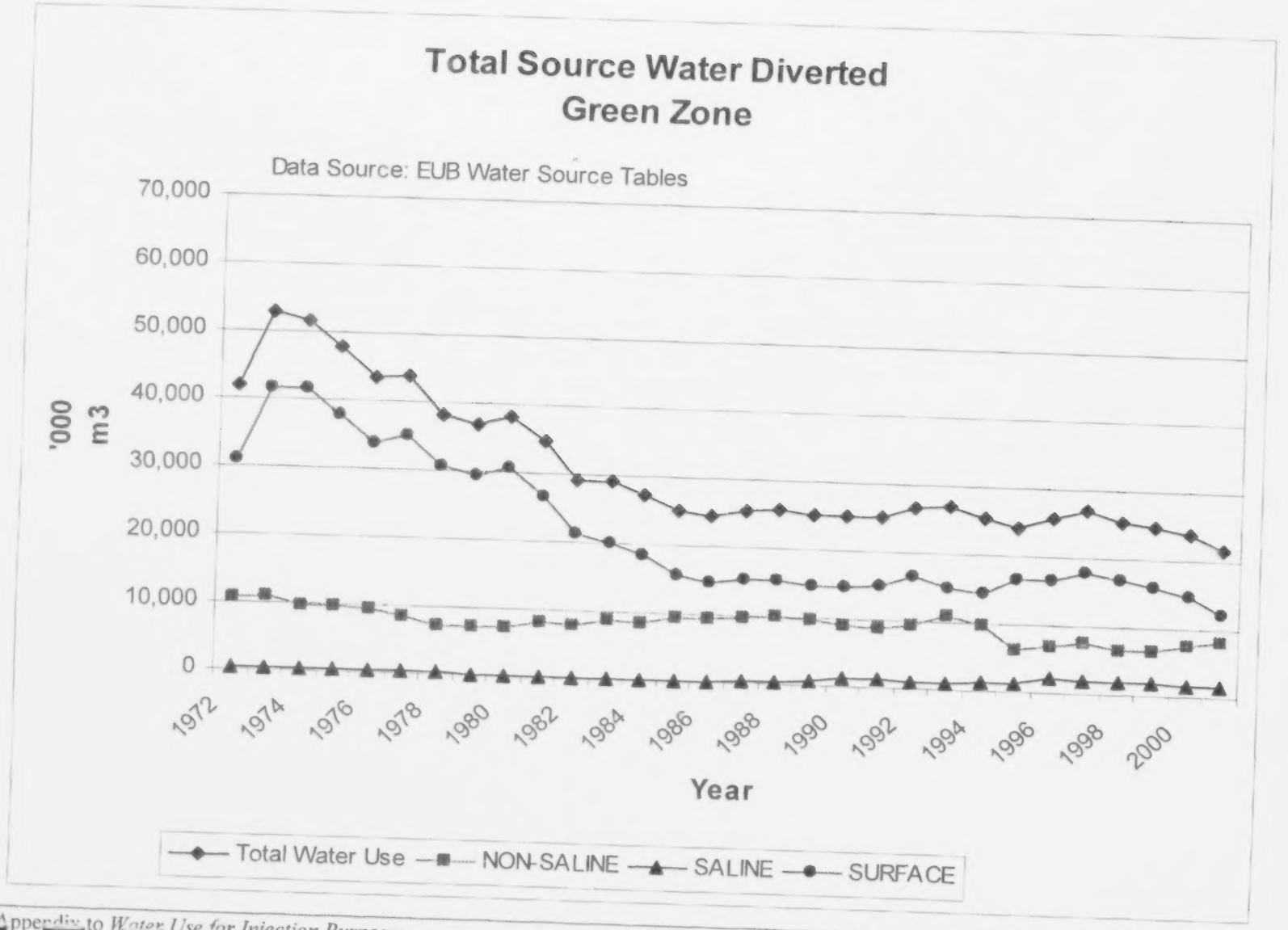

Table 8: Total Source Water Diverted Green Zone (m^3)

YEAR	Total Water Use	NON-SALINE	SALINE	SURFACE
1972	41,855,539	10,571,539	257,616	31,026,384
1973	52,809,753	11,005,840	298,611	41,505,302
1974	51,578,394	9,689,198	340,546	41,548,649
1975	47,856,637	9,671,289	433,628	37,751,720
1976	43,483,221	9,438,984	385,305	33,658,932
1977	43,763,145	8,349,405	349,493	35,064,247
1978	38,164,660	7,044,535	399,746	30,720,380
1979	36,808,145	7,314,055	125,175	29,368,915
1980	38,064,251	7,256,583	107,126	30,700,541
1981	34,633,674	8,052,767	114,552	26,466,356
1982	28,983,119	7,782,472	93,874	21,106,773
1983	28,972,236	8,869,840	112,282	19,990,115
1984	27,047,011	8,486,130	72,658	18,488,224
1985	25,034,162	9,343,714	128,413	15,562,036
1986	24,360,462	9,411,761	107,934	14,840,767
1987	25,327,978	9,835,026	224,910	15,268,042
1988	25,638,193	10,052,230	231,283	15,354,679
1989	24,884,967	9,607,414	490,929	14,786,625
1990	24,898,807	9,005,537	1,135,986	14,757,284
1991	24,984,023	8,785,066	1,151,429	15,047,527
1992	26,648,711	9,406,337	810,250	16,432,124
1993	26,954,878	10,824,834	1,003,334	15,126,709
1994	25,206,000	9,702,675	1,186,280	14,317,045
1995	24,101,377	6,328,245	1,285,581	16,487,551
1996	25,588,988	6,754,630	2,310,833	16,523,525
1997	26,851,572	7,447,702	1,732,582	17,671,288
1998	25,192,055	6,563,284	1,768,608	16,860,162
1999	24,556,812	6,642,059	1,915,948	15,998,804
2000	23,772,826	7,592,788	1,535,453	14,644,585
2001	21,680,170	8,012,652	1,476,316	12,191,202

Figure 9: Source Water Diverted for Conventional Use Green Zone (m^3)

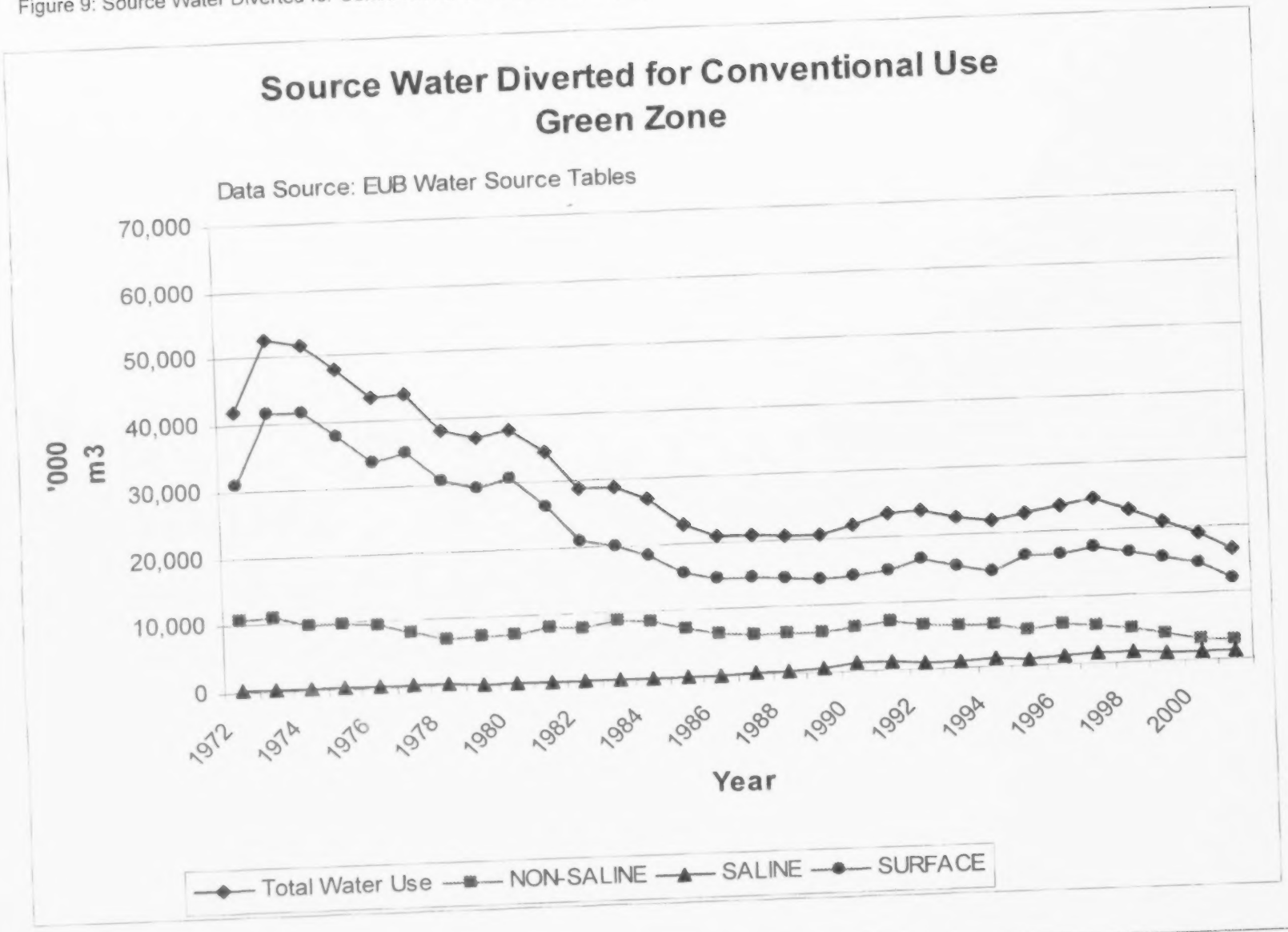

Table 9: Source Water Diverted for Conventional Use Green Zone (m^3)

YEAR	Total Water Use	NON-SALINE	SALINE	SURFACE
1972	41,855,539	10,571,539	257,616	31,026,384
1973	52,809,753	11,005,840	298,611	41,505,302
1974	51,578,394	9,689,198	340,546	41,548,649
1975	47,856,637	9,671,289	433,628	37,751,720
1976	43,483,221	9,438,984	385,305	33,658,932
1977	43,763,145	8,349,405	349,493	35,064,247
1978	38,164,153	7,044,028	399,746	30,720,380
1979	36,801,143	7,311,042	125,175	29,364,926
1980	37,880,621	7,254,275	107,126	30,519,220
1981	34,416,767	8,050,827	114,552	26,251,389
1982	28,828,647	7,767,518	93,874	20,967,254
1983	28,711,732	8,843,791	112,282	19,755,659
1984	26,695,527	8,452,632	72,658	18,170,238
1985	22,668,047	7,143,723	128,413	15,395,911
1986	20,771,970	6,188,493	107,934	14,475,544
1987	20,715,924	6,086,059	224,910	14,404,956
1988	20,575,501	6,049,405	231,283	14,294,813
1989	20,541,670	6,078,772	490,929	13,971,969
1990	21,828,320	6,472,472	1,135,986	14,219,862
1991	23,352,439	7,294,995	1,151,429	14,906,015
1992	23,739,623	6,627,944	810,250	16,301,429
1993	22,386,339	6,270,274	1,003,334	15,112,731
1994	21,711,089	6,207,764	1,186,280	14,317,045
1995	22,808,117	5,247,545	1,073,021	16,487,551
1996	23,664,239	5,895,752	1,297,372	16,471,115
1997	24,526,217	5,584,818	1,689,211	17,252,188
1998	22,779,099	5,098,439	1,420,700	16,259,959
1999	20,703,842	3,985,327	1,287,387	15,431,128
2000	19,067,896	3,180,892	1,392,844	14,494,161
2001	16,243,216	2,908,095	1,332,732	12,002,388

Figure 10: Source Water Diverted for Conventional Use Milk River Basin (m^3)

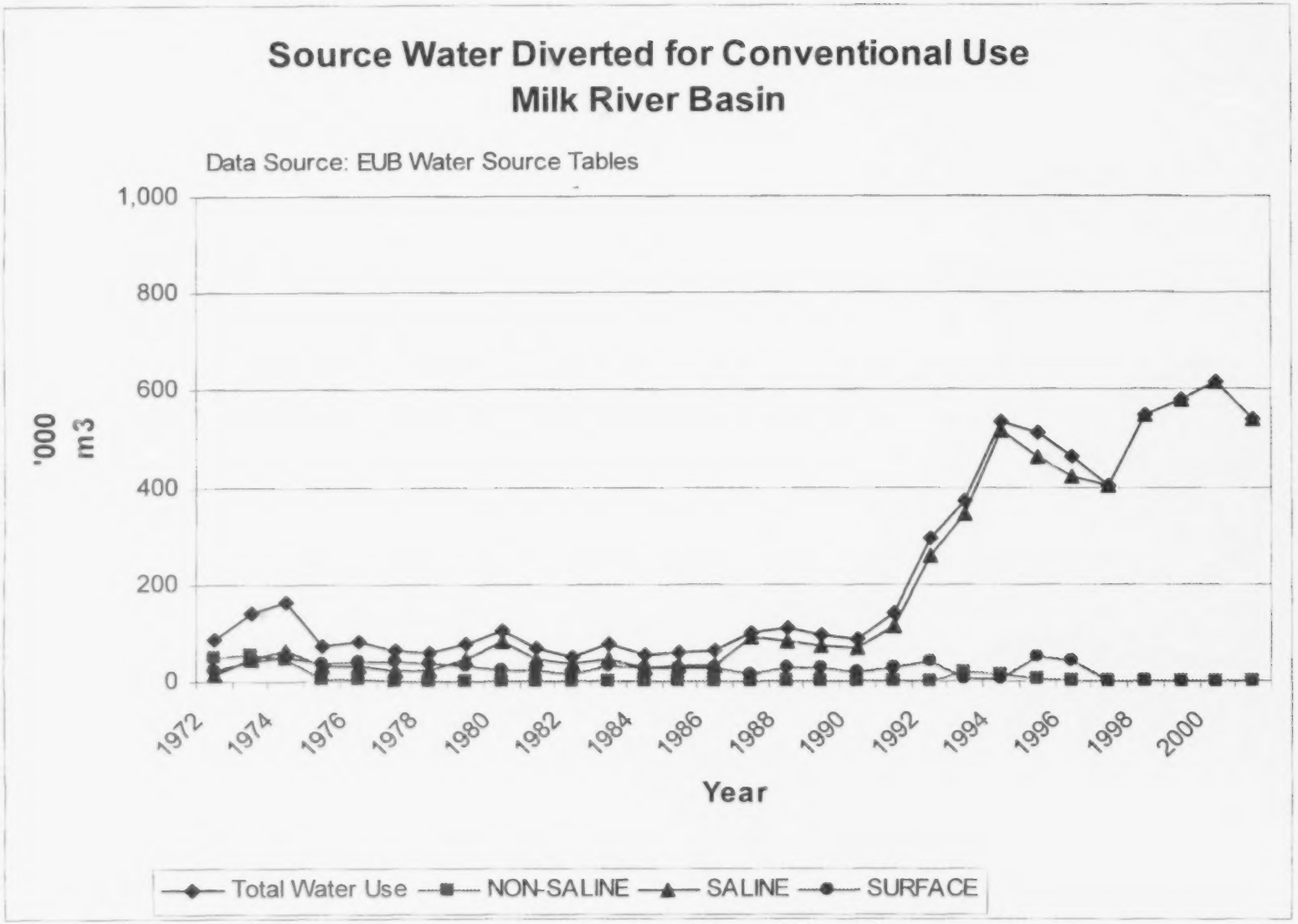

Table 10: Source Water Diverted for Conventional Use Milk River Basin (m^3)

YEAR	Total Water Use	NON-SALINE	SALINE	SURFACE
1972	85,915	51,049	14,357	20,509
1973	138,203	54,096	44,374	39,732
1974	162,070	45,363	64,965	51,742
1975	72,258	2,610	31,959	37,689
1976	79,769	5,096	31,702	42,971
1977	62,321	1,489	21,403	39,429
1978	60,999	0	24,291	36,708
1979	75,064	0	43,065	31,999
1980	104,270	0	82,661	21,610
1981	67,078	0	43,400	23,677
1982	49,309	0	36,164	13,145
1983	76,006	0	44,344	31,662
1984	54,607	0	26,576	28,031
1985	57,574	0	31,171	26,403
1986	61,202	0	32,726	28,476
1987	100,399	0	88,433	11,966
1988	107,887	0	81,963	25,924
1989	97,056	0	71,213	25,843
1990	86,862	0	69,042	17,821
1991	141,214	0	114,682	26,533
1992	295,739	0	255,866	39,873
1993	369,797	19,018	344,902	5,877
1994	534,250	12,523	515,659	6,068
1995	511,584	2,989	459,782	48,813
1996	461,380	0	421,903	39,477
1997	404,329	0	404,329	0
1998	546,419	0	546,419	0
1999	577,373	0	577,373	0
2000	615,578	0	615,578	0
2001	539,101	0	539,101	0

Figure 11: Source Water Diverted for Conventional Use South Sask. River Basin (m^3)

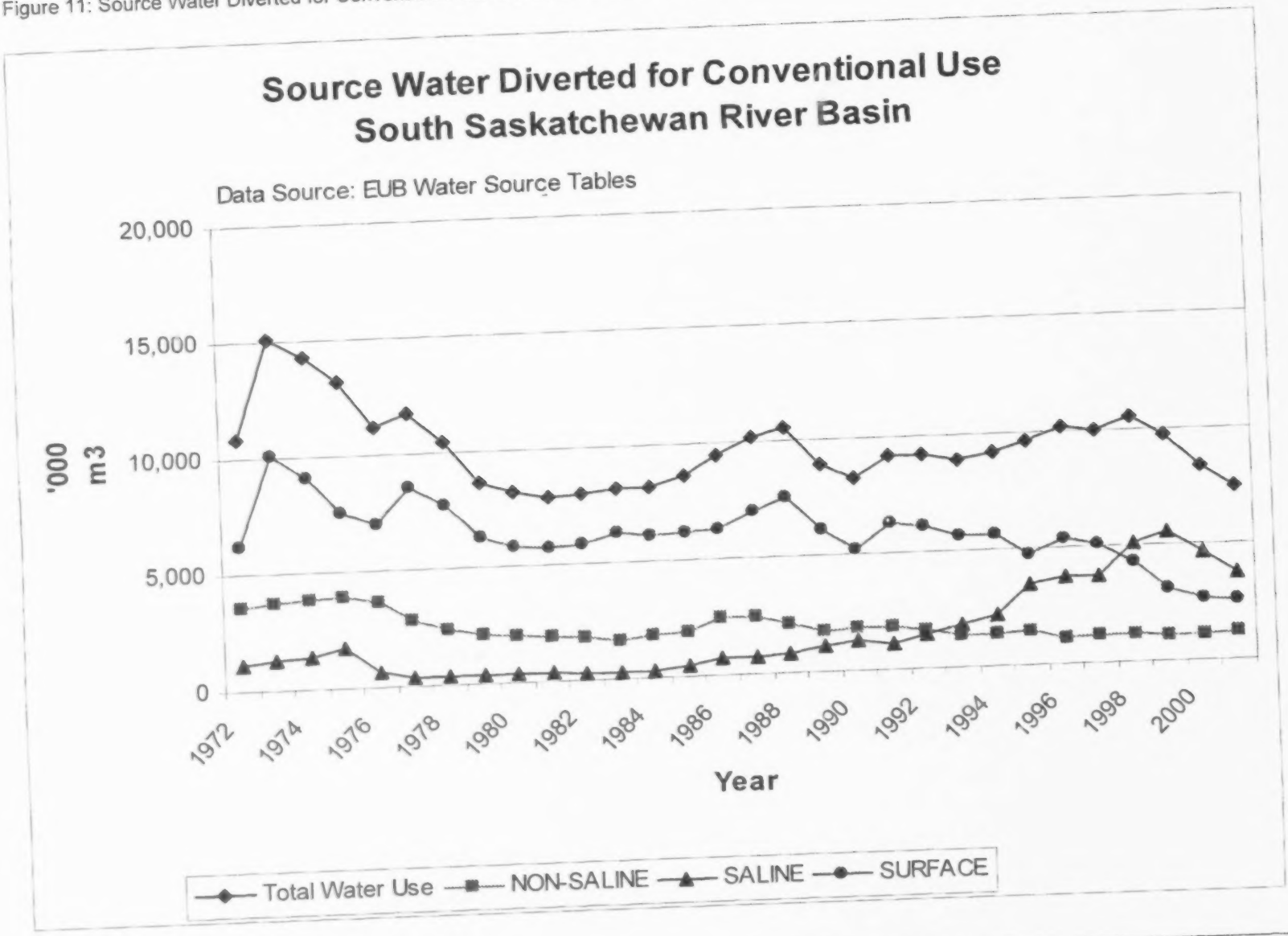

Table 11: Source Water Diverted for Conventional Use South Sask. River Basin (m^3)

YEAR	Total Water Use	NON-SALINE	SALINE	SURFACE
1972	10,841,087	3,560,573	1,109,378	6,171,137
1973	15,109,408	3,753,967	1,281,838	10,073,602
1974	14,302,113	3,857,442	1,393,234	9,051,437
1975	13,224,413	3,949,787	1,696,428	7,578,198
1976	11,180,251	3,618,821	602,392	6,959,039
1977	11,724,999	2,856,769	342,049	8,526,182
1978	10,484,590	2,324,457	389,477	7,770,656
1979	8,657,272	2,047,288	366,048	6,243,936
1980	8,150,598	1,964,861	356,548	5,829,190
1981	7,944,817	1,865,535	395,864	5,683,418
1982	7,965,895	1,815,548	290,568	5,859,779
1983	8,201,633	1,641,180	266,418	6,294,036
1984	8,217,466	1,854,965	280,140	6,082,360
1985	8,646,870	1,950,869	495,463	6,200,539
1986	9,466,071	2,442,846	727,476	6,295,749
1987	10,173,132	2,434,207	754,098	6,984,827
1988	10,511,257	2,112,175	863,591	7,535,491
1989	8,893,774	1,720,432	1,066,344	6,106,998
1990	8,266,950	1,806,427	1,243,221	5,217,302
1991	9,171,248	1,805,381	1,129,293	6,236,573
1992	9,182,861	1,615,287	1,455,213	6,112,361
1993	8,877,986	1,397,781	1,862,899	5,617,305
1994	9,166,983	1,324,770	2,204,400	5,637,814
1995	9,672,771	1,477,633	3,431,465	4,763,674
1996	10,179,736	1,057,455	3,741,055	5,381,227
1997	10,043,070	1,175,731	3,746,825	5,120,515
1998	10,570,138	1,166,411	5,117,617	4,286,110
1999	9,726,939	1,127,085	5,505,307	3,094,548
2000	8,334,035	1,051,199	4,666,850	2,615,987
2001	7,475,578	1,182,705	3,717,198	2,575,674

Figure 12: Source Water Diverted for Conventional Use North Sask. River Basin (m^3)

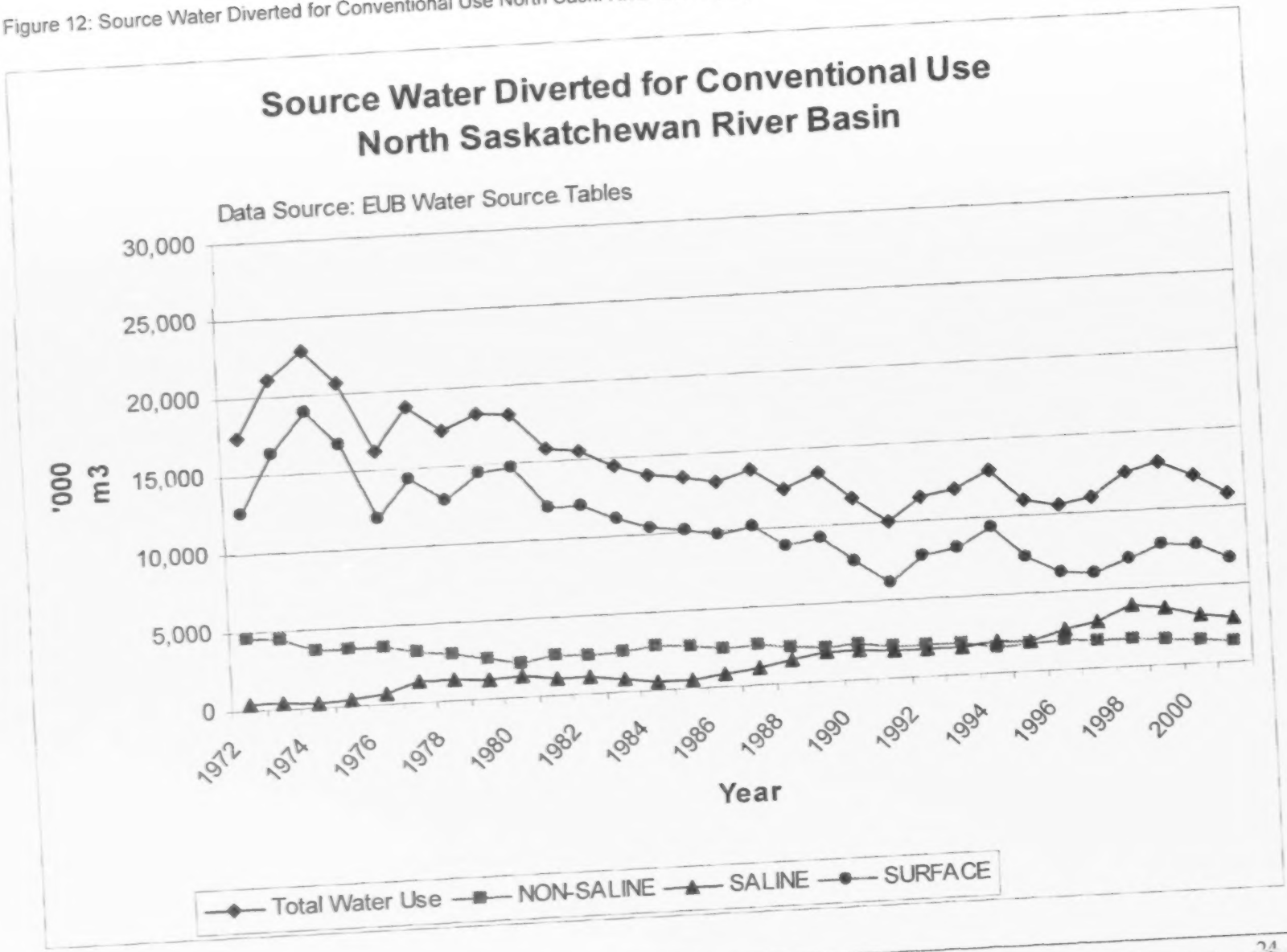

Table 12: Source Water Diverted for Conventional Use North Sask. River Basin (m^3)

YEAR	Total Water Use	NON-SALINE	SALINE	SURFACE
1972	17,437,571	4,545,095	358,118	12,534,358
1973	21,126,777	4,411,758	344,885	16,370,134
1974	22,876,953	3,636,098	270,359	18,970,495
1975	20,685,408	3,583,708	341,396	16,760,303
1976	16,180,054	3,608,277	615,432	11,956,346
1977	18,864,879	3,205,245	1,336,080	14,323,553
1978	17,266,789	3,001,561	1,378,992	12,886,236
1979	18,289,915	2,573,118	1,234,382	14,482,415
1980	18,164,245	2,097,454	1,339,467	14,727,324
1981	15,750,137	2,522,472	1,136,194	12,091,471
1982	15,592,769	2,486,770	1,124,213	11,981,786
1983	14,493,844	2,589,876	776,922	11,127,046
1984	13,824,817	2,837,724	594,474	10,392,618
1985	13,521,011	2,725,270	602,240	10,193,502
1986	13,097,524	2,482,195	877,244	9,738,085
1987	13,803,554	2,616,418	1,117,844	10,069,293
1988	12,482,679	2,295,874	1,426,155	8,760,650
1989	13,346,977	2,206,140	1,953,349	9,187,488
1990	11,647,806	2,245,913	1,844,170	7,557,724
1991	9,944,445	2,093,246	1,718,239	6,132,960
1992	11,475,204	1,980,049	1,749,646	7,745,509
1993	11,887,934	1,991,755	1,768,738	8,127,441
1994	12,948,639	1,629,034	2,015,806	9,303,799
1995	10,924,203	1,720,373	1,948,276	7,255,554
1996	10,562,472	1,824,952	2,502,188	6,235,332
1997	10,936,639	1,800,036	3,023,888	6,112,715
1998	12,469,869	1,699,070	3,941,667	6,829,132
1999	12,930,245	1,626,188	3,645,712	7,658,346
2000	12,078,657	1,427,050	3,056,970	7,594,638
2001	10,803,525	1,345,793	2,813,557	6,644,175

Figure 13: Source Water Diverted for Conventional Use Athabasca River Basin (m^3)

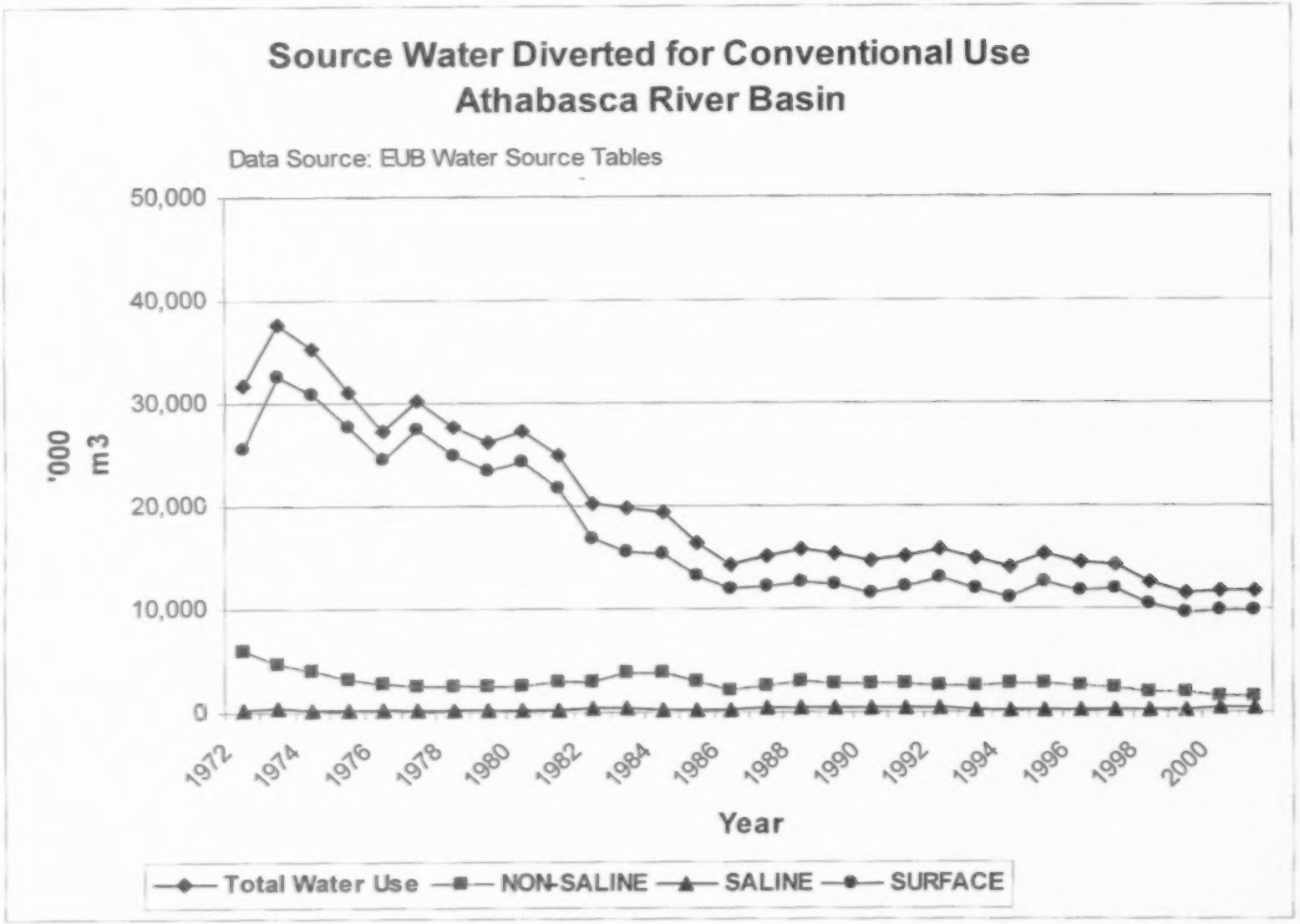

Table 13: Source Water Diverted for Conventional Use Athabasca River Basin (m^3)

YEAR	Total Water Use	NON-SALINE	SALINE	SURFACE
1972	31,733,153	5,869,296	280,858	25,582,999
1973	37,605,546	4,725,331	333,291	32,546,924
1974	35,274,857	4,101,900	236,669	30,936,288
1975	31,027,874	3,231,443	168,573	27,627,858
1976	27,339,180	2,782,011	159,604	24,397,564
1977	30,138,600	2,514,073	188,134	27,436,393
1978	27,628,150	2,487,249	169,352	24,971,549
1979	26,157,235	2,657,315	156,409	23,343,511
1980	27,178,096	2,604,273	226,326	24,347,497
1981	24,968,304	2,935,182	234,716	21,798,406
1982	20,182,321	2,930,350	351,212	16,900,759
1983	19,743,716	3,812,271	400,469	15,530,976
1984	19,434,707	3,859,868	297,997	15,276,843
1985	16,409,125	2,903,196	310,858	13,195,071
1986	14,274,503	2,084,873	198,500	11,991,131
1987	15,068,640	2,566,897	348,572	12,153,171
1988	15,822,786	2,942,264	386,542	12,493,980
1989	15,417,724	2,820,577	334,425	12,262,722
1990	14,621,080	2,679,236	408,651	11,533,192
1991	15,091,234	2,686,846	348,942	12,055,446
1992	15,821,038	2,549,093	352,479	12,919,466
1993	14,913,468	2,622,644	299,804	11,991,019
1994	13,986,620	2,695,288	290,767	11,000,565
1995	15,394,702	2,689,024	256,621	12,449,057
1996	14,407,885	2,569,705	239,756	11,598,424
1997	14,308,920	2,290,022	208,999	11,809,899
1998	12,600,043	2,017,274	147,049	10,435,721
1999	11,563,564	1,915,822	149,273	9,498,469
2000	11,693,301	1,561,259	404,867	9,727,175
2001	11,804,111	1,459,189	513,329	9,831,593

Figure 14: Source Water Diverted for Conventional Use Peace River Basin (m^3)

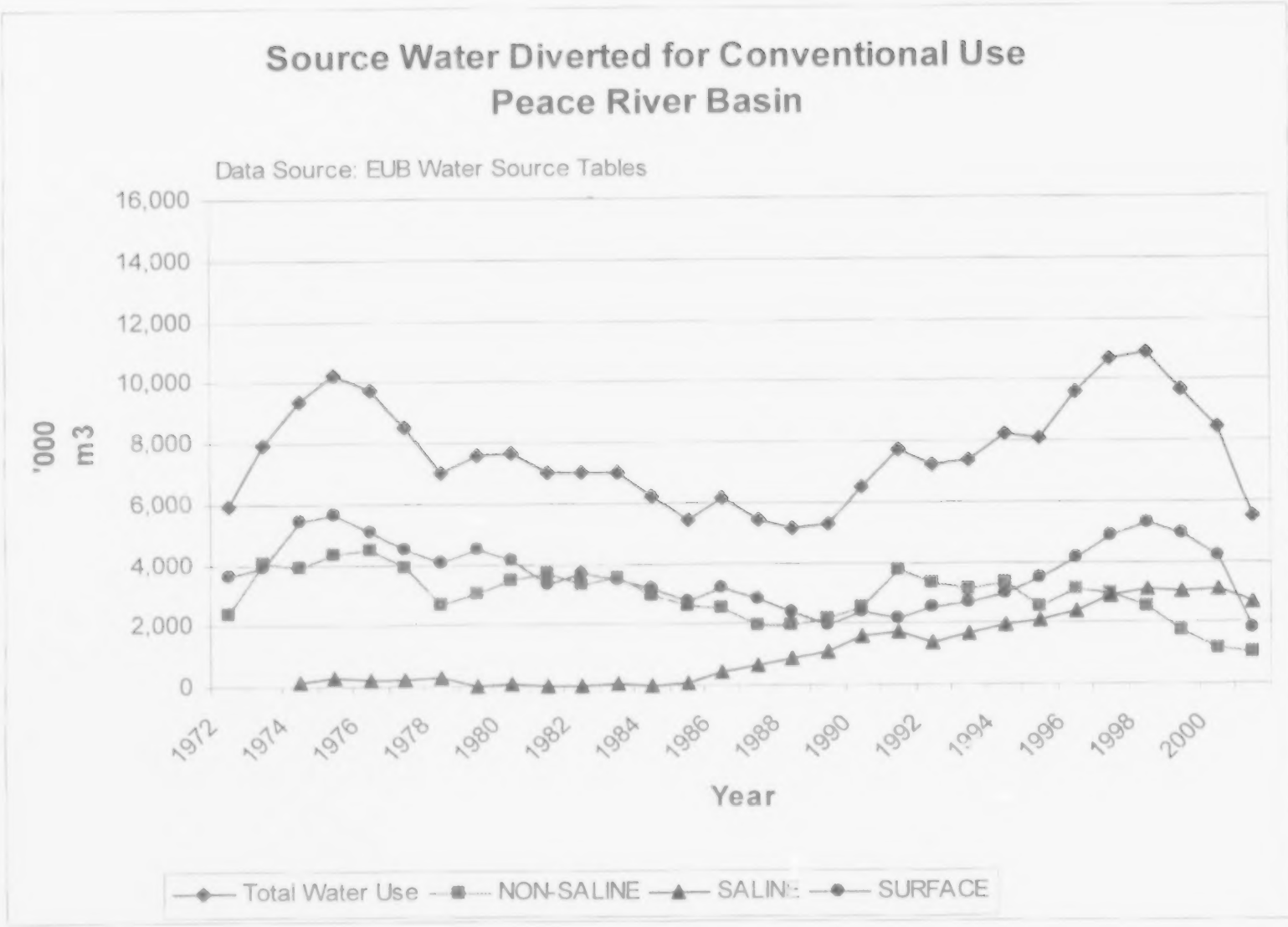

Table 14: Source Water Diverted for Conventional Use Peace River Basin (m^3)

YEAR	Total Water Use	NON-SALINE	SALINE	SURFACE
1972	5,940,151	2,357,427		3,582,724
1973	7,916,579	4,027,301		3,889,278
1974	9,375,268	3,865,260	138,423	5,371,585
1975	10,240,547	4,329,452	270,640	5,640,455
1976	9,725,803	4,477,846	216,278	5,031,679
1977	8,536,803	3,893,021	210,053	4,433,728
1978	7,021,925	2,694,286	265,399	4,062,240
1979	7,540,307	3,048,039	34,995	4,457,273
1980	7,634,408	3,488,369	43,374	4,102,665
1981	7,014,284	3,663,471	31,813	3,319,001
1982	6,972,944	3,306,247	25,313	3,641,383
1983	7,025,372	3,541,501	53,600	3,430,271
1984	6,177,512	2,967,157	22,522	3,187,833
1985	5,393,095	2,581,702	71,261	2,740,133
1986	6,119,764	2,510,417	412,169	3,197,178
1987	5,371,681	1,912,762	660,433	2,798,487
1988	5,138,034	1,922,357	830,061	2,385,617
1989	5,227,607	2,171,682	1,116,970	1,938,955
1990	6,499,303	2,542,803	1,586,240	2,370,259
1991	7,698,651	3,770,537	1,753,436	2,174,679
1992	7,211,407	3,312,254	1,383,498	2,515,656
1993	7,381,123	3,111,725	1,629,677	2,639,722
1994	8,243,890	3,341,754	1,932,516	2,969,619
1995	8,097,439	2,539,193	2,080,007	3,478,239
1996	9,607,536	3,099,471	2,364,563	4,143,502
1997	10,644,331	2,951,089	2,869,825	4,823,416
1998	10,866,224	2,518,135	3,120,331	5,227,759
1999	9,640,969	1,703,070	3,015,234	4,922,665
2000	8,436,252	1,167,141	3,102,017	4,167,094
2001	5,507,795	1,021,299	2,697,855	1,788,641

Figure 15: Source Water Diverted for Conventional Use Hay River Basin (m^3)

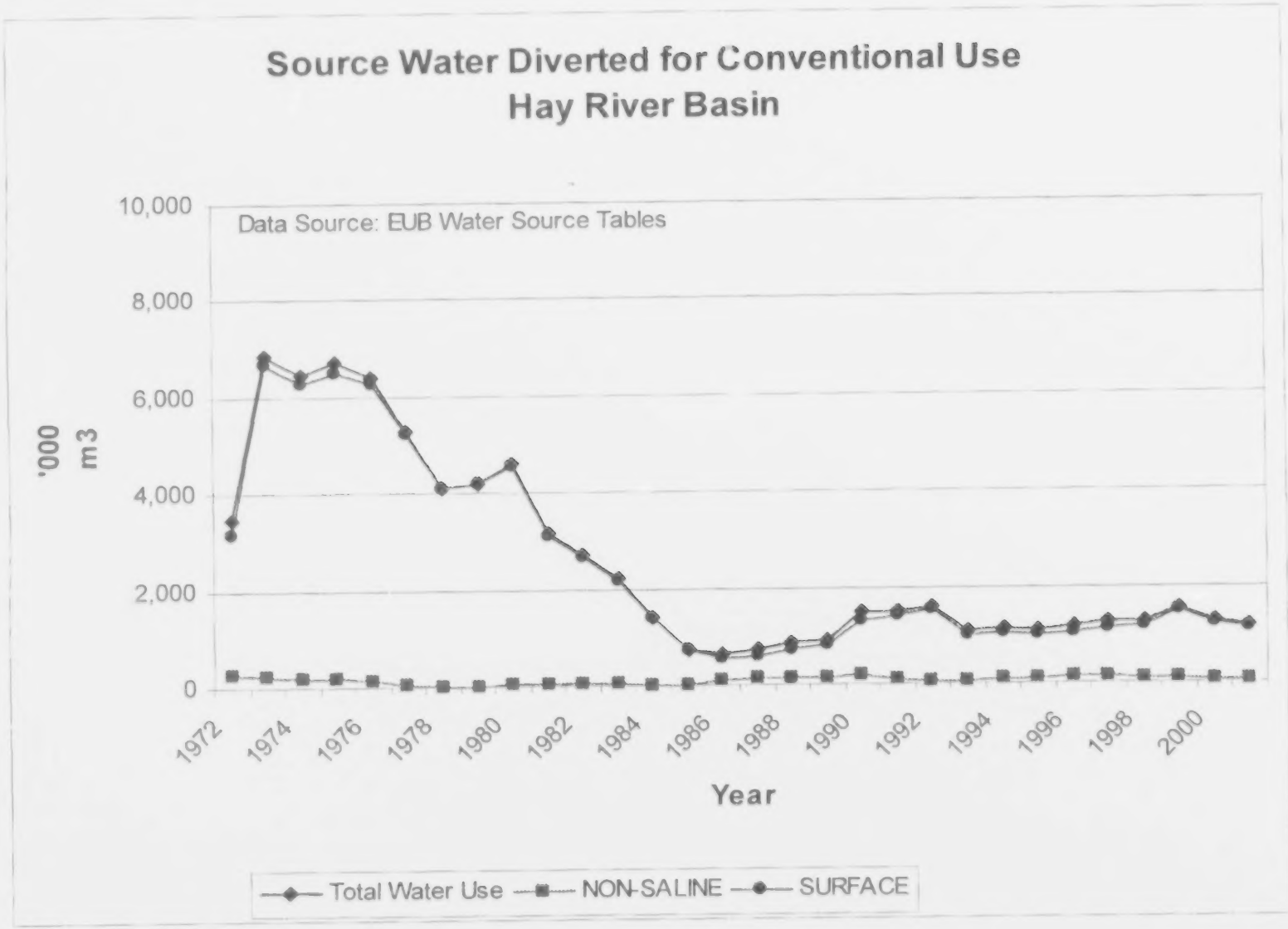

Table 15: Source Water Diverted for Conventional Use Hay River Basin (m^3)

YEAR	Total Water Use	NON-SALINE	SURFACE
1972	3,459,184	287,842	3,171,342
1973	6,864,354	208,386	6,655,968
1974	6,454,535	197,582	6,256,953
1975	6,707,197	200,300	6,506,897
1976	6,409,424	142,061	6,267,364
1977	5,262,063	38,488	5,223,575
1978	4,100,942	0	4,100,942
1979	4,175,981	1,749	4,174,232
1980	4,586,402	30,952	4,555,450
1981	3,148,443	28,938	3,119,505
1982	2,690,780	46,507	2,644,273
1983	2,205,273	29,452	2,175,821
1984	1,382,027	0	1,382,027
1985	737,623	1,183	736,440
1986	638,606	84,426	554,180
1987	734,011	140,836	593,175
1988	878,371	155,017	723,354
1989	911,155	121,416	789,740
1990	1,503,887	201,778	1,302,109
1991	1,492,685	78,469	1,414,216
1992	1,592,974	64,433	1,528,541
1993	1,071,642	66,436	1,005,206
1994	1,109,452	78,379	1,031,073
1995	1,070,875	96,048	974,827
1996	1,161,658	132,115	1,029,543
1997	1,252,120	119,768	1,132,352
1998	1,258,646	85,714	1,172,932
1999	1,543,775	75,321	1,468,454
2000	1,246,472	29,951	1,216,521
2001	1,162,202	43,716	1,118,486

Figure 16: Source Water Diverted for Conventional Use Liard River Basin (m^3)

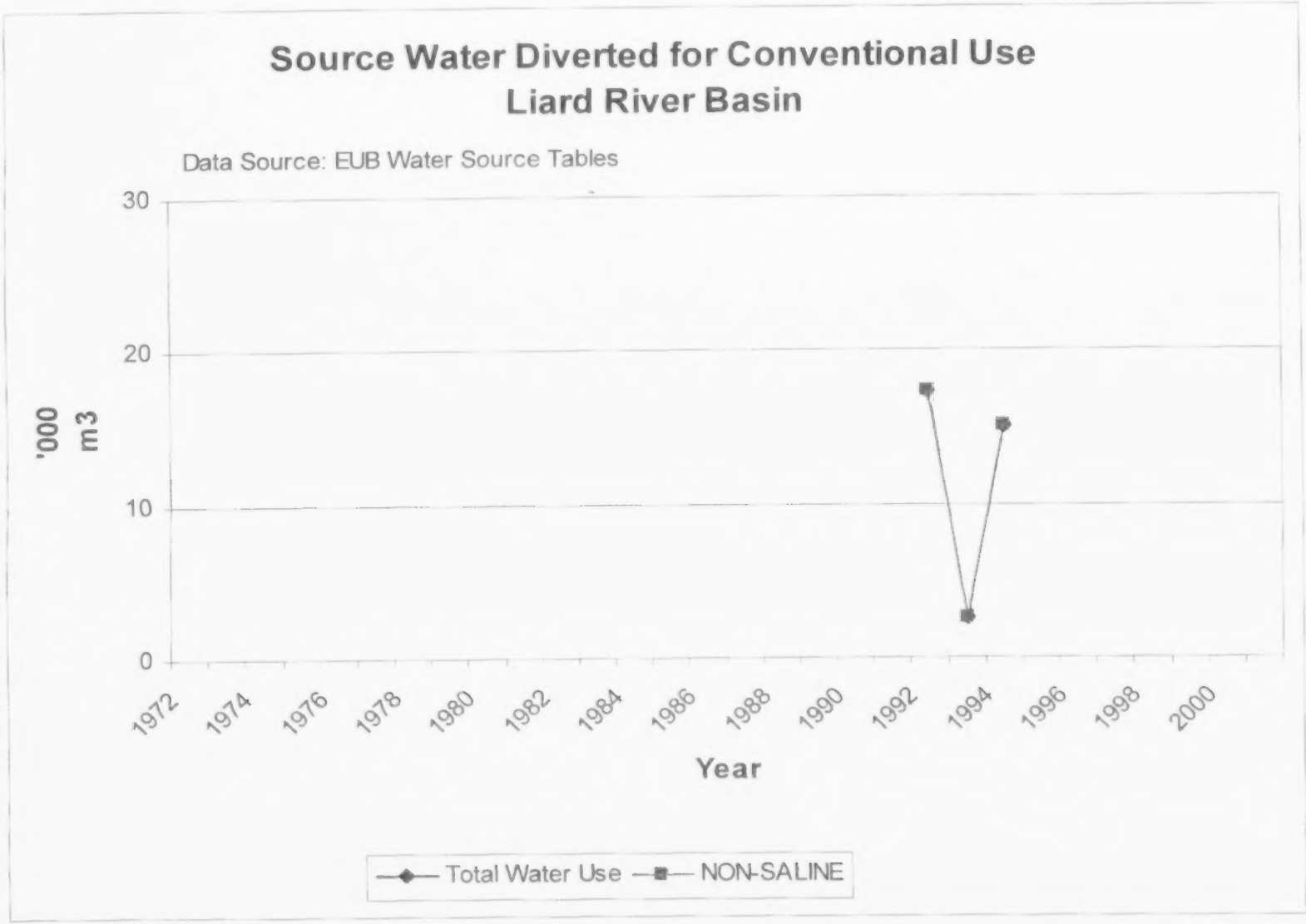

Table 16: Source Water Diverted for Conventional Use Liard River Basin (m^3)

YEAR	Total Water Use	NON-SALINE
1972		
1973		
1974		
1975		
1976		
1977		
1978		
1979		
1980		
1981		
1982		
1983		
1984		
1985		
1986		
1987		
1988		
1989		
1990		
1991		
1992	17,289	17,289
1993	2,503	2,503
1994	15,007	15,007
1995		
1996		
1997		
1998		
1999		
2000		
2001		

Figure 17: Provincial Summary of Conventional Project Data (m^3)

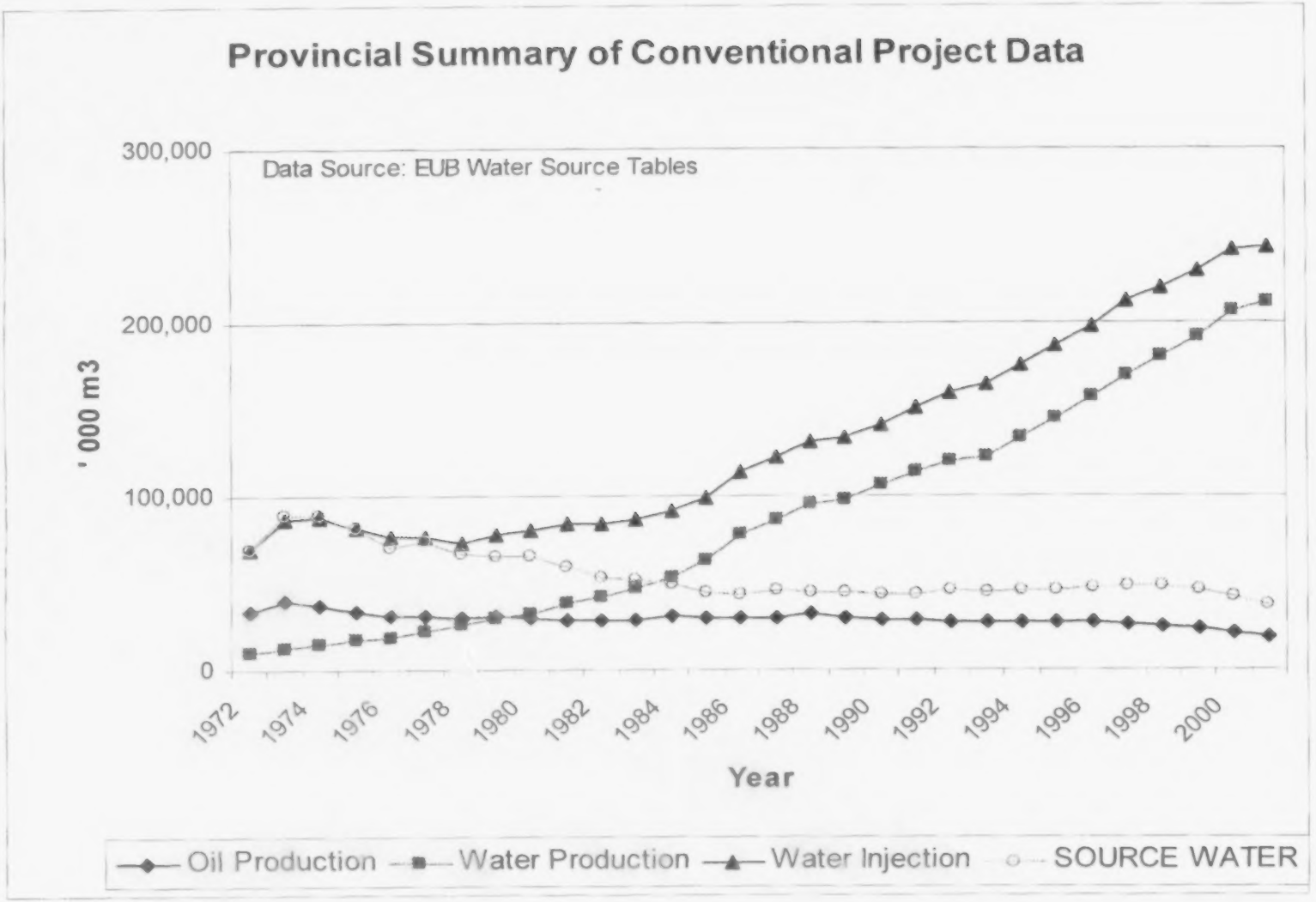

Table 17: Provincial Summary of Conventional Project Data (m^3)

Year	Oil Production	Water Production	Water Injection
1972	33,413,388	9,501,042	69,159,263
1973	39,832,073	12,316,621	86,643,328
1974	37,210,241	15,050,957	87,606,144
1975	33,262,194	16,975,685	81,983,532
1976	30,928,601	18,928,470	76,240,384
1977	30,880,626	22,449,444	77,107,804
1978	29,863,712	25,631,345	73,363,962
1979	31,086,855	29,197,344	77,510,091
1980	29,236,219	31,828,001	79,671,664
1981	29,001,151	38,285,209	84,165,963
1982	28,141,428	41,605,698	83,487,132
1983	28,942,745	46,649,572	86,259,859
1984	30,515,431	53,354,138	91,892,242
1985	29,778,818	63,188,994	98,488,622
1986	29,081,045	77,663,961	113,725,671
1987	30,204,885	85,803,246	122,706,262
1988	31,501,129	94,628,361	130,974,895
1989	30,097,258	97,961,433	133,477,038
1990	28,840,972	106,211,901	140,624,060
1991	27,895,698	113,196,391	150,039,098
1992	27,742,071	119,487,644	159,752,711
1993	27,011,975	122,468,298	164,094,317
1994	26,881,983	133,005,404	174,832,957
1995	27,268,597	144,396,402	186,248,402
1996	26,960,743	157,000,304	197,139,461
1997	25,764,693	169,707,893	211,895,288
1998	24,840,116	179,893,826	220,133,156
1999	22,963,976	191,323,204	229,995,138
2000	21,303,707	205,774,476	241,667,033
2001	19,068,952	211,190,675	243,415,291

Figure 18: Summary of Conventional Project Data White Zone (m^3)

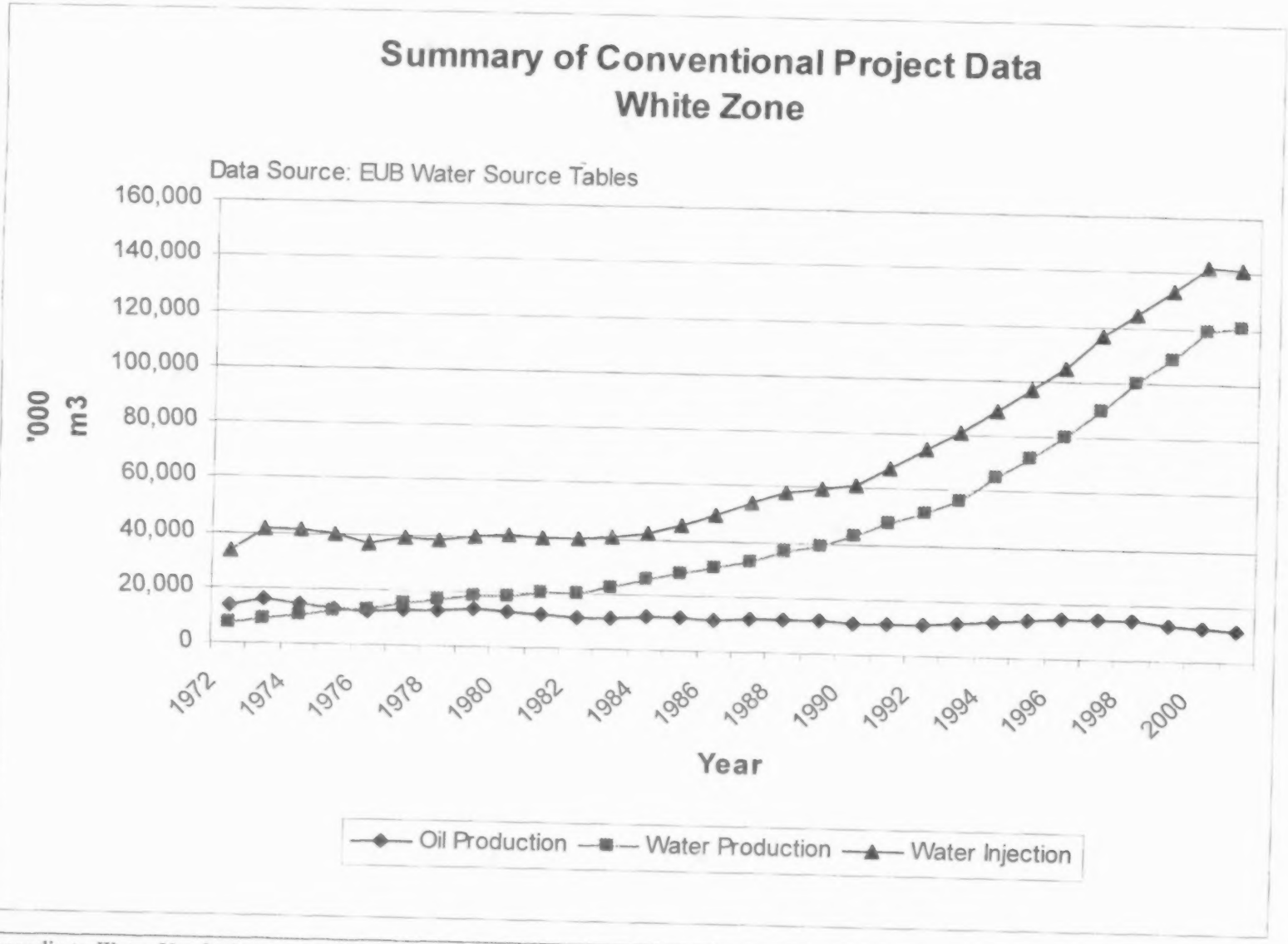

Table 18: Summary of Conventional Project Data White Zone (m^3)

Year	Oil Production	Water Production	Water Injection
1972	13,753,916	7,049,974	33,572,491
1973	16,082,149	8,892,298	41,551,985
1974	14,483,720	10,472,367	41,459,774
1975	12,794,888	12,014,724	39,773,099
1976	11,885,024	12,958,407	36,635,286
1977	12,809,686	14,888,240	38,715,943
1978	12,569,519	16,459,980	38,368,047
1979	13,203,583	17,842,775	39,747,510
1980	12,446,570	18,587,634	40,647,638
1981	11,879,616	19,705,863	39,347,508
1982	11,033,311	19,956,744	39,754,241
1983	11,358,152	22,333,429	40,037,721
1984	11,690,598	25,175,191	41,821,157
1985	11,815,881	27,692,881	44,887,422
1986	11,369,205	30,190,953	49,419,007
1987	11,532,724	32,605,653	53,544,507
1988	12,227,371	36,487,388	57,765,524
1989	11,675,253	38,678,157	59,424,813
1990	11,180,023	42,458,491	61,073,459
1991	11,052,165	47,301,518	67,210,720
1992	11,310,689	51,822,456	74,783,235
1993	11,934,570	56,025,336	80,634,218
1994	12,802,984	64,723,738	88,551,750
1995	13,740,096	72,382,614	96,743,855
1996	14,209,682	80,205,414	104,857,792
1997	14,032,845	89,664,857	116,561,026
1998	14,093,085	99,733,300	124,745,651
1999	12,993,575	108,341,547	132,928,220
2000	12,040,740	118,858,721	142,144,088
2001	10,714,354	120,417,304	141,355,837

Figure 19: Summary of Conventional Project Data Green Zone (m^3)

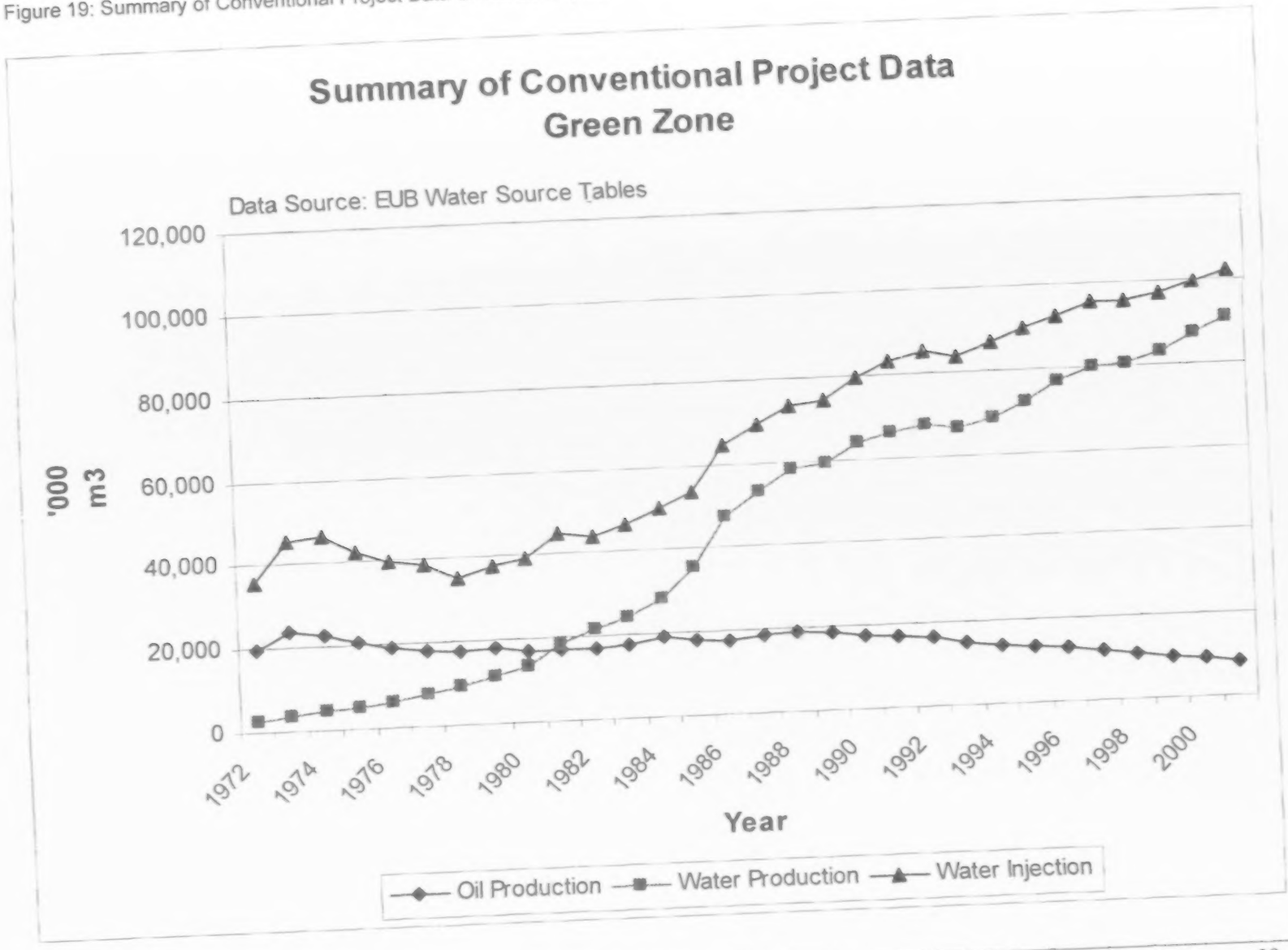

Table 19: Summary of Conventional Project Data Green Zone (m^3)

Year	Oil Production	Water Production	Water Injection
1972	19,659,472	2,451,068	35,586,772
1973	23,749,924	3,424,322	45,091,343
1974	22,726,522	4,578,590	46,146,369
1975	20,467,306	4,960,962	42,210,433
1976	19,043,577	5,970,064	39,605,098
1977	18,070,940	7,561,203	38,391,862
1978	17,294,193	9,171,365	34,995,915
1979	17,883,272	11,354,569	37,762,581
1980	16,789,648	13,240,367	39,024,027
1981	17,121,535	18,579,346	44,818,455
1982	17,108,117	21,648,955	43,732,891
1983	17,584,593	24,316,143	46,222,137
1984	18,824,833	28,178,947	50,071,085
1985	17,962,937	35,496,114	53,601,200
1986	17,711,840	47,473,008	64,306,664
1987	18,672,161	53,197,593	69,161,755
1988	19,273,758	58,140,972	73,209,371
1989	18,422,005	59,283,276	74,052,225
1990	17,660,949	63,753,410	79,550,601
1991	16,843,534	65,894,872	82,828,378
1992	16,431,383	67,665,188	84,969,476
1993	15,077,405	66,442,962	83,460,099
1994	14,078,999	68,281,667	86,281,207
1995	13,528,502	72,013,788	89,504,547
1996	12,751,061	76,794,890	92,281,669
1997	11,731,848	80,043,036	95,334,262
1998	10,747,031	80,160,526	95,387,506
1999	9,970,401	82,981,657	97,066,919
2000	9,262,967	86,915,755	99,522,945
2001	8,354,599	90,773,371	102,059,454

Figure 20: Summary of Conventional Project Data Milk River Basin (m^3)

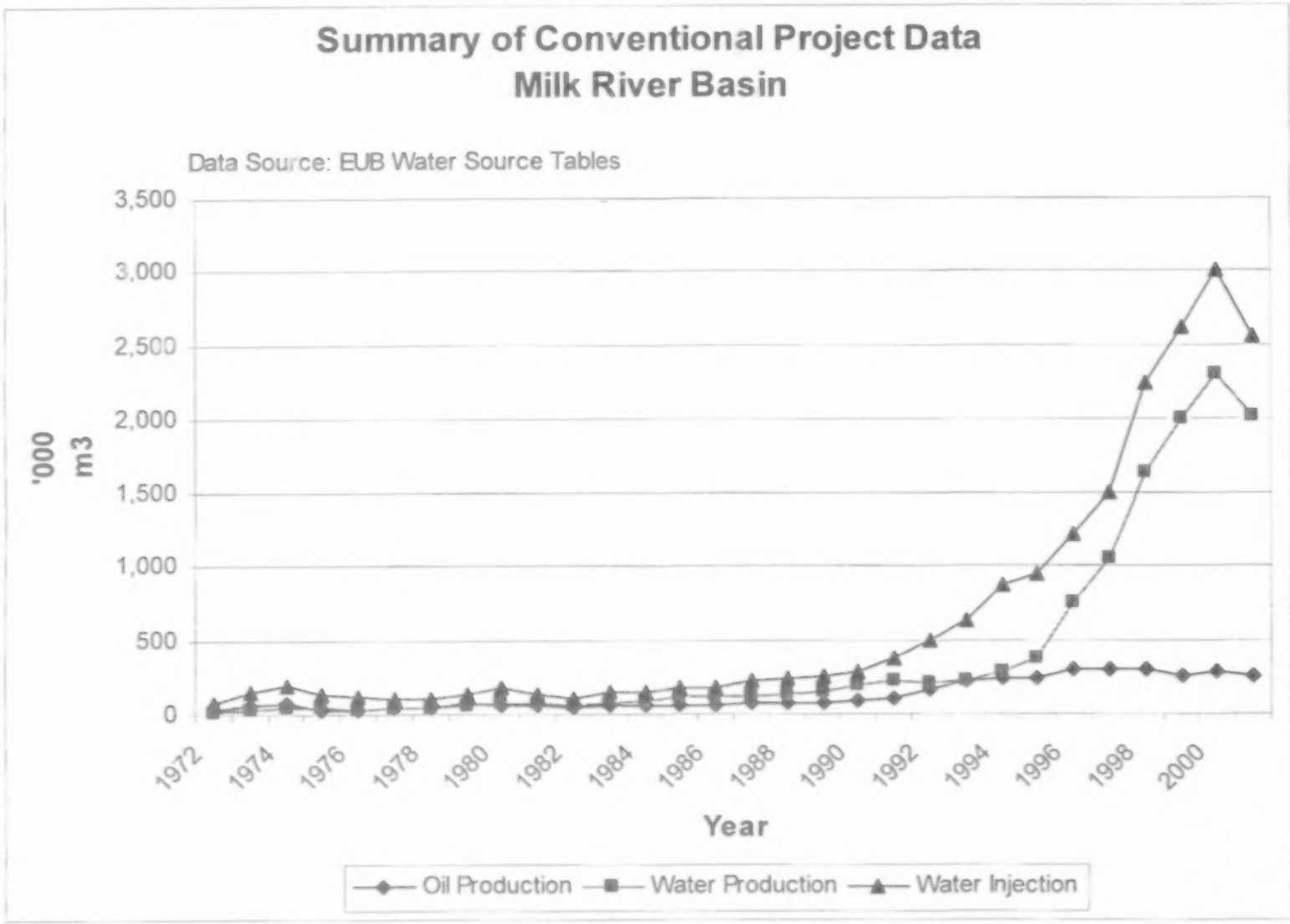

Table 20: Summary of Conventional Project Data Milk River Basin (m^3)

Year	Oil Production	Water Production	Water Injection
1972	36,497	10,994	80,357
1973	62,522	33,674	152,511
1974	70,686	43,957	193,458
1975	35,392	46,032	128,300
1976	37,326	37,081	121,033
1977	38,299	41,652	106,798
1978	49,849	49,453	110,985
1979	73,356	61,581	141,869
1980	66,287	70,024	181,967
1981	53,431	75,603	142,358
1982	46,175	61,481	111,905
1983	54,708	71,105	149,692
1984	57,718	93,353	144,332
1985	55,416	118,597	176,366
1986	58,403	121,943	185,965
1987	77,052	127,091	227,972
1988	78,452	132,824	246,674
1989	74,503	156,533	255,537
1990	84,354	190,382	289,143
1991	103,417	219,769	381,078
1992	171,227	208,959	499,013
1993	222,745	232,375	628,342
1994	233,351	289,017	867,449
1995	239,592	373,000	951,554
1996	298,188	751,805	1,213,251
1997	300,520	1,055,148	1,502,260
1998	304,616	1,644,583	2,242,997
1999	256,819	2,003,022	2,608,262
2000	291,710	2,296,030	3,001,275
2001	256,698	2,016,593	2,548,206

Figure 21: Summary of Conventional Project Data South Saskatchewan R. Basin (m^3)

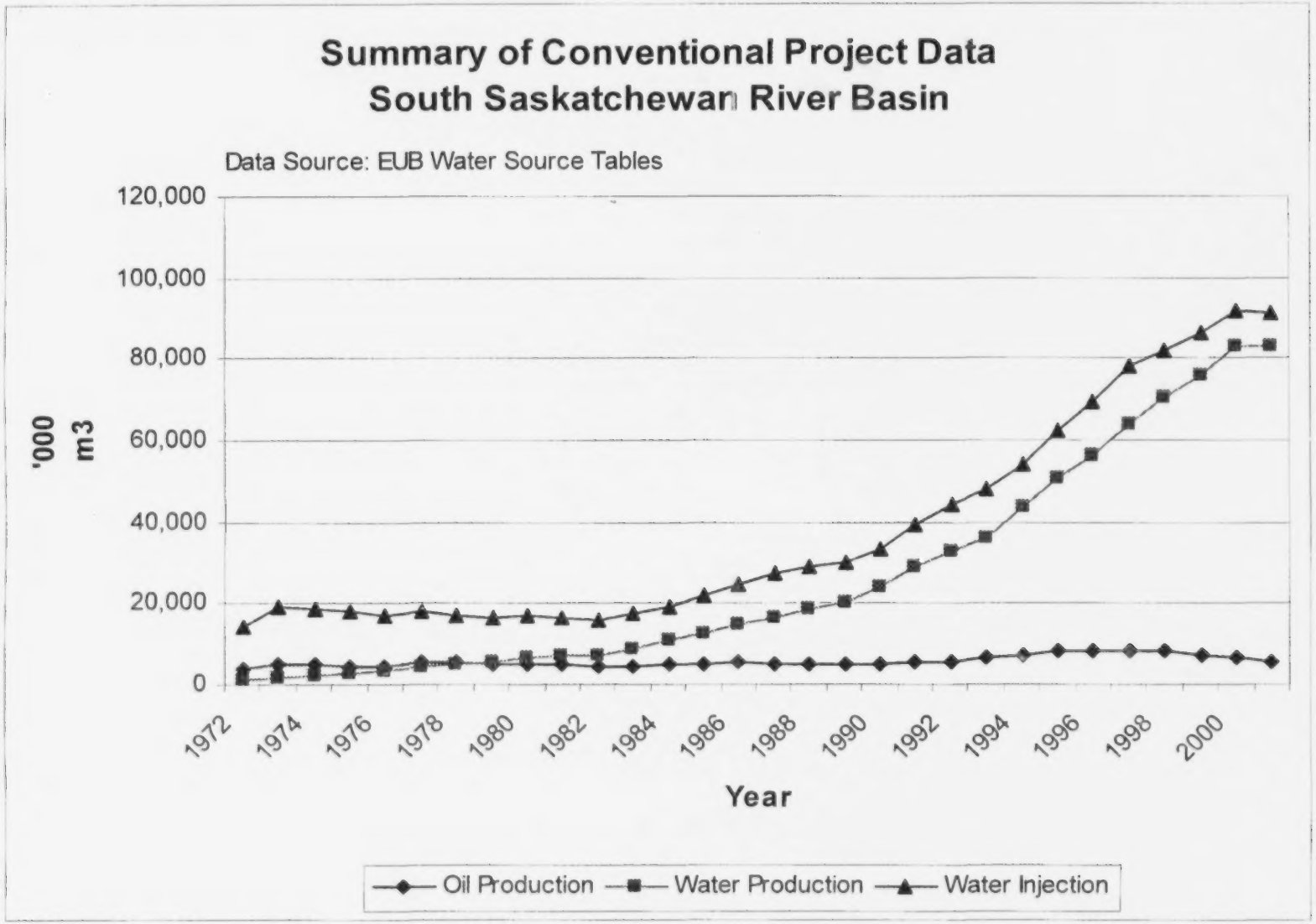

Table 21: Summary of Conventional Project Data South Saskatchewan R. Basin (m^3)

Year	Oil Production	Water Production	Water Injection
1972	4,037,951	1,051,241	14,217,763
1973	5,084,349	1,511,937	18,830,376
1974	4,807,054	1,913,101	18,657,454
1975	4,635,340	2,550,238	18,212,145
1976	4,534,604	3,116,881	16,651,012
1977	5,244,626	4,274,069	17,862,440
1978	5,241,916	5,047,324	17,019,615
1979	5,142,214	5,688,796	16,418,547
1980	4,915,751	6,431,804	16,892,011
1981	4,753,653	7,357,840	16,541,288
1982	4,118,971	7,347,814	16,041,529
1983	4,363,786	8,947,544	17,300,981
1984	4,702,049	10,892,717	19,297,873
1985	5,084,174	12,745,083	21,672,166
1986	5,234,646	14,547,448	24,561,953
1987	5,079,831	16,320,631	27,327,193
1988	5,012,255	18,382,100	28,992,348
1989	4,927,783	20,270,275	29,789,319
1990	5,049,489	24,173,382	33,143,355
1991	5,246,218	29,109,230	39,076,745
1992	5,629,791	32,816,097	44,226,619
1993	6,367,005	36,046,116	48,147,002
1994	7,240,265	43,543,437	53,905,483
1995	8,017,662	50,624,392	62,152,374
1996	8,251,659	56,433,757	69,060,627
1997	8,198,736	63,903,017	77,790,259
1998	8,031,923	70,447,675	81,563,882
1999	7,022,009	75,905,679	85,959,075
2000	6,420,021	82,950,147	91,662,855
2001	5,606,484	83,048,757	91,038,193

Figure 22: Summary of Conventional Project Data North Saskatchewan R. Basin (m^3)

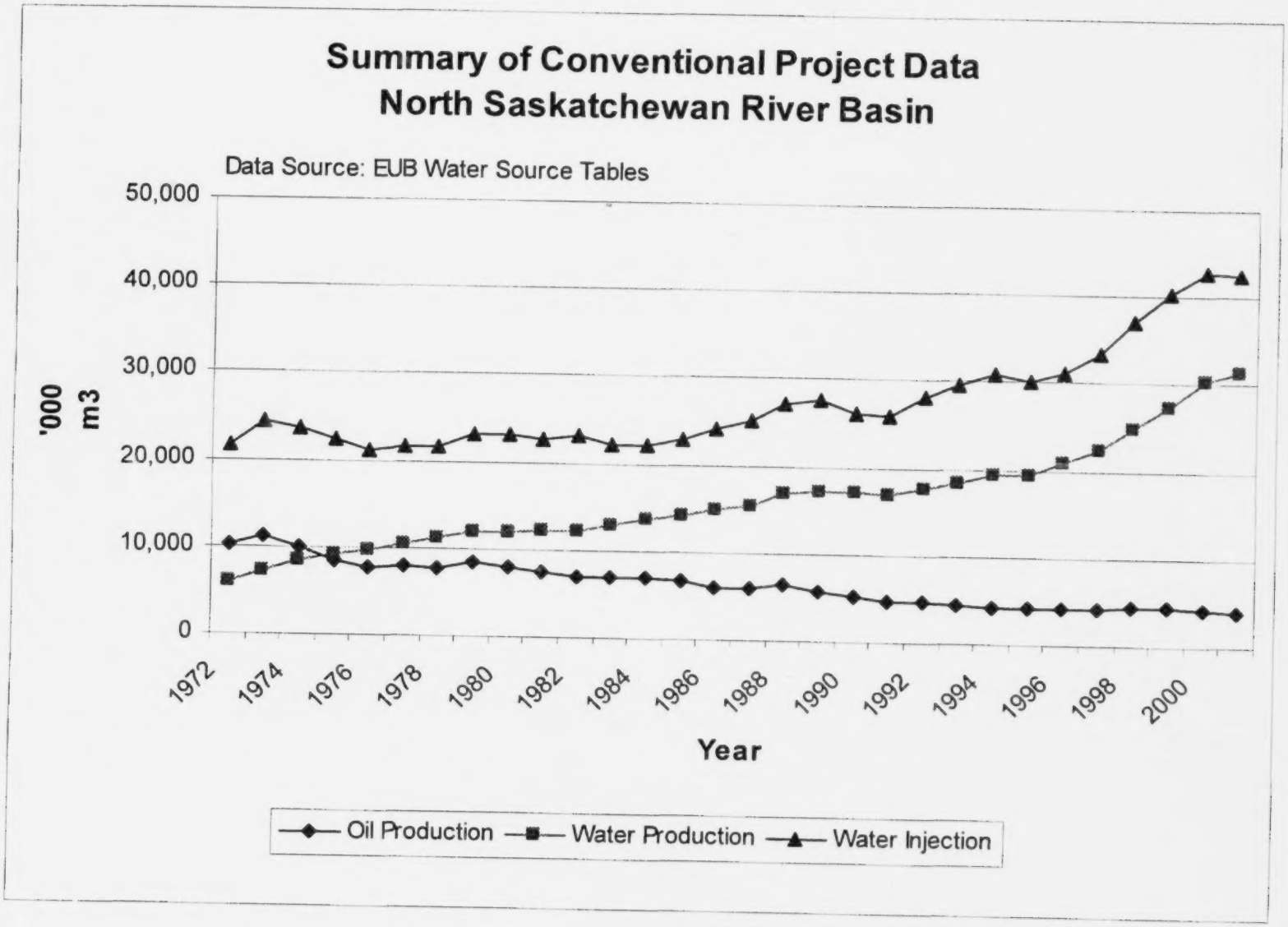

Table 22: Summary of Conventional Project Data North Saskatchewan R. Basin (m^3)

Year	Oil Production	Water Production	Water Injection
1972	10,120,178	5,899,371	21,656,338
1973	11,211,253	7,241,170	24,322,167
1974	9,976,708	8,395,492	23,690,881
1975	8,475,847	9,261,456	22,452,358
1976	7,713,570	9,635,533	21,076,279
1977	7,956,977	10,407,399	21,643,239
1978	7,765,751	11,186,182	21,755,512
1979	8,520,863	11,875,011	23,199,969
1980	7,935,242	11,846,480	23,093,061
1981	7,469,073	12,064,826	22,613,583
1982	7,071,434	12,228,669	23,095,775
1983	7,045,915	12,850,302	22,118,648
1984	6,875,768	13,611,580	22,257,397
1985	6,678,446	14,196,752	22,790,114
1986	5,937,958	14,883,896	24,115,865
1987	5,954,705	15,393,341	25,088,733
1988	6,361,647	17,007,514	27,017,866
1989	5,774,148	17,199,082	27,711,253
1990	5,182,284	17,055,165	26,044,699
1991	4,832,072	16,853,379	25,943,022
1992	4,607,904	17,630,306	28,032,061
1993	4,373,879	18,436,822	29,595,495
1994	4,264,065	19,335,145	30,872,839
1995	4,129,874	19,498,772	30,176,423
1996	4,337,384	20,827,948	31,[illegible]8,279
1997	4,341,655	22,276,872	33,[illegible]2,903
1998	4,568,021	24,871,968	36,965,922
1999	4,515,708	27,343,752	40,382,987
2000	4,265,602	30,257,857	42,744,480
2001	3,946,760	31,274,333	42,558,365

Figure 23: Summary of Conventional Project Data Athabasca River Basin (m^3)

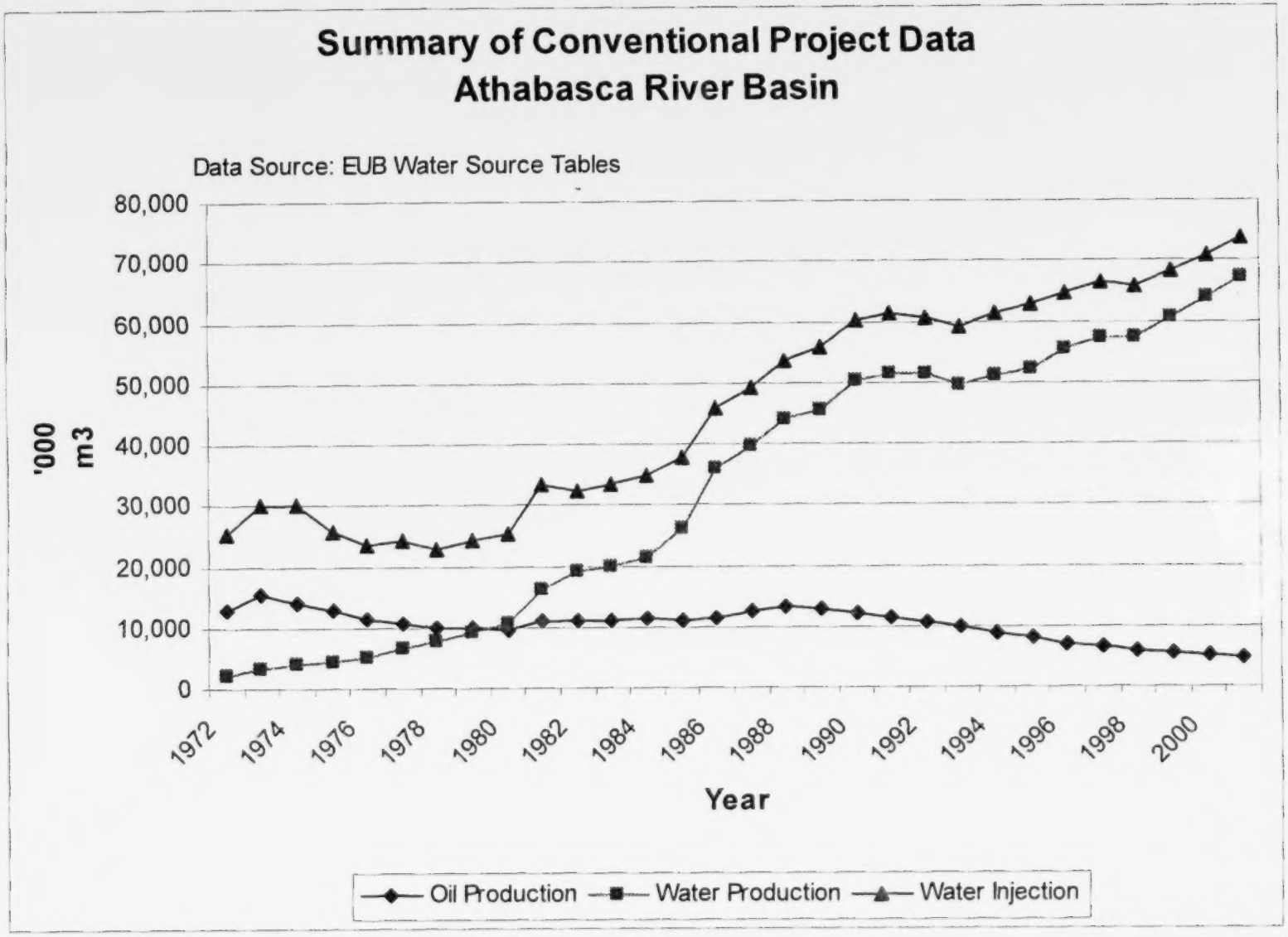

Table 23: Summary of Conventional Project Data Athabasca River Basin (m^3)

Year	Oil Production	Water Production	Water Injection
1972	12,854,152	2,337,245	25,226,644
1973	15,255,237	3,183,724	30,209,233
1974	14,081,693	4,178,480	30,217,768
1975	12,840,742	4,450,842	25,825,477
1976	11,485,586	5,220,963	23,496,252
1977	10,756,218	6,526,111	24,253,890
1978	9,844,651	7,572,335	22,914,930
1979	9,870,041	9,310,882	24,287,848
1980	9,490,601	10,568,832	25,366,100
1981	10,869,680	16,146,904	33,214,866
1982	11,145,725	18,903,954	32,415,909
1983	11,162,347	19,845,090	33,392,799
1984	11,445,071	21,165,618	34,790,444
1985	10,972,229	26,177,824	37,858,312
1986	11,406,016	36,062,753	45,805,852
1987	12,404,145	39,771,584	49,347,199
1988	13,298,171	44,103,843	53,666,159
1989	12,942,606	45,603,622	55,871,140
1990	12,082,798	50,305,771	60,032,004
1991	11,412,731	51,472,556	61,125,464
1992	10,776,491	51,333,675	60,580,920
1993	9,744,002	49,497,737	59,201,289
1994	8,864,592	50,930,510	61,428,484
1995	7,934,638	52,013,577	62,933,985
1996	7,121,726	55,293,306	64,638,586
1997	6,542,283	57,370,137	66,487,058
1998	6,035,710	57,427,161	65,779,783
1999	5,626,518	60,686,195	68,162,554
2000	5,288,832	63,723,633	70,776,662
2001	4,949,199	67,033,153	73,694,285

Figure 24: Summary of Conventional Project Data Peace River Basin (m^3)

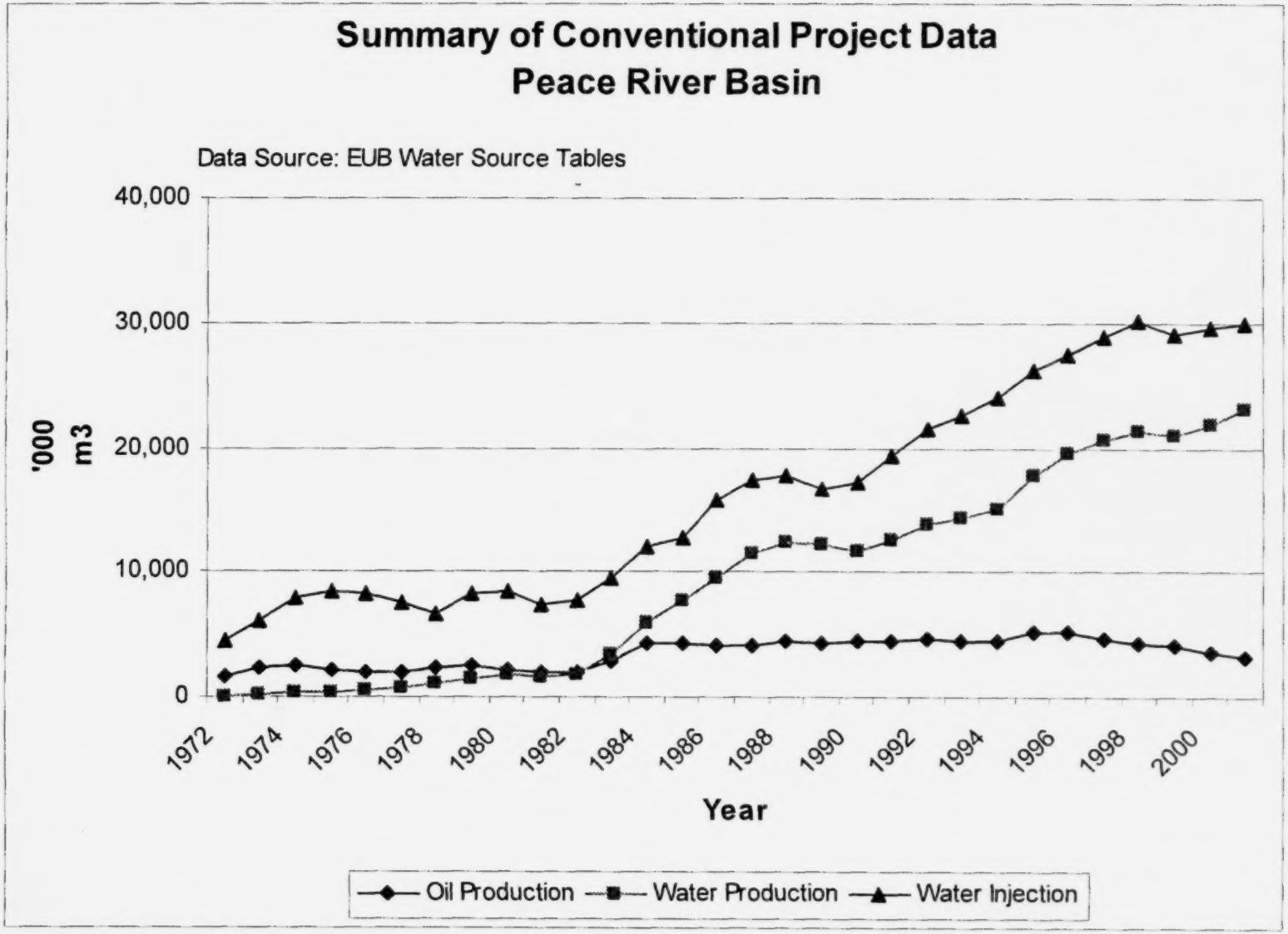

Table 24: Summary of Conventional Project Data Peace River Basin (m^3)

Year	Oil Production	Water Production	Water Injection
1972	1,685,105	47,688	4,455,463
1973	2,265,070	119,329	6,035,796
1974	2,466,567	291,830	7,809,782
1975	2,192,875	383,992	8,447,040
1976	2,033,764	612,123	8,226,071
1977	1,969,912	790,243	7,528,073
1978	2,253,380	1,120,154	6,692,045
1979	2,558,288	1,406,917	8,285,995
1980	2,216,683	1,832,128	8,366,721
1981	1,944,400	1,598,591	7,323,155
1982	2,055,707	1,843,207	7,691,777
1983	2,872,919	3,444,560	9,432,511
1984	4,284,865	5,935,819	12,004,902
1985	4,294,955	7,756,586	12,779,912
1986	4,055,462	9,593,373	15,757,139
1987	4,178,418	11,478,769	17,450,590
1988	4,473,673	12,405,626	17,802,755
1989	4,229,106	12,233,082	16,613,877
1990	4,459,245	11,746,867	17,173,973
1991	4,439,204	12,617,590	19,436,703
1992	4,622,522	13,756,139	21,586,911
1993	4,525,280	14,361,064	22,540,294
1994	4,559,522	15,112,571	24,021,288
1995	5,145,441	17,728,008	26,170,347
1996	5,193,842	19,521,132	27,376,551
1997	4,698,630	20,540,625	28,871,128
1998	4,347,113	21,349,114	30,118,769
1999	4,096,479	21,060,910	28,984,751
2000	3,665,169	21,802,160	29,614,330
2001	3,147,918	23,113,806	29,958,469

Figure 25: Summary of Conventional Project Data Hay River Basin (m^3)

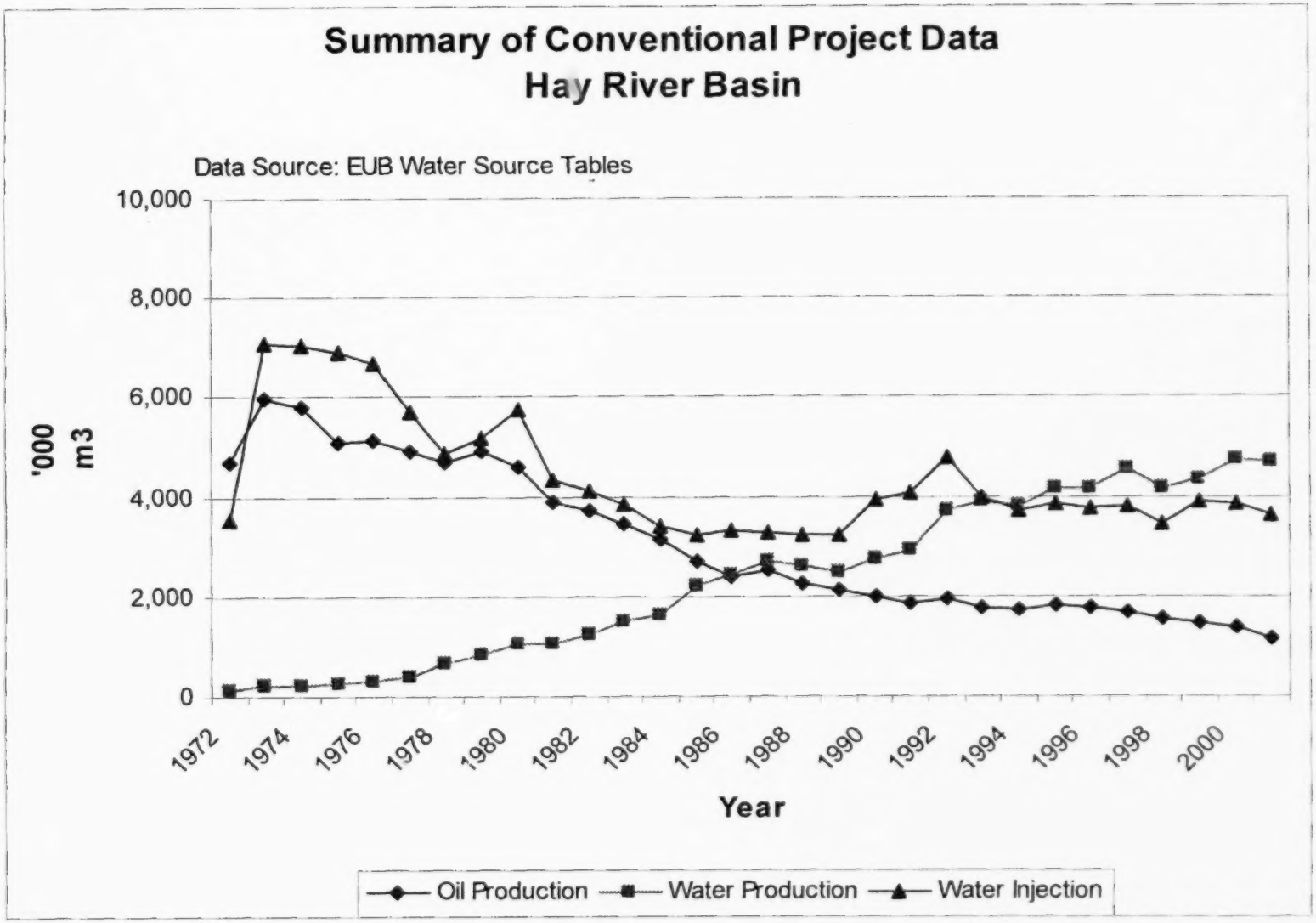

Table 25: Summary of Conventional Project Data Hay River Basin (m^3)

Year	Oil Production	Water Production	Water Injection
1972	4,679,507	154,504	3,522,699
1973	5,953,641	226,787	7,093,244
1974	5,807,533	228,097	7,036,802
1975	5,081,998	283,126	6,918,212
1976	5,123,751	305,889	6,669,737
1977	4,914,594	409,971	5,713,365
1978	4,708,165	655,898	4,870,876
1979	4,922,093	854,156	5,175,863
1980	4,611,655	1,078,733	5,771,805
1981	3,910,914	1,041,447	4,330,714
1982	3,703,416	1,220,573	4,130,236
1983	3,443,070	1,490,970	3,865,228
1984	3,149,960	1,655,051	3,397,293
1985	2,693,597	2,194,152	3,211,752
1986	2,388,560	2,454,547	3,298,897
1987	2,509,062	2,710,035	3,253,153
1988	2,271,931	2,596,443	3,224,758
1989	2,142,840	2,498,812	3,215,405
1990	1,971,100	2,738,487	3,923,584
1991	1,853,763	2,912,881	4,051,944
1992	1,924,795	3,736,300	4,795,145
1993	1,769,743	3,892,467	3,969,869
1994	1,717,705	3,788,340	3,708,916
1995	1,801,389	4,157,866	3,854,808
1996	1,757,833	4,172,083	3,761,160
1997	1,682,242	4,559,233	3,823,072
1998	1,552,733	4,153,326	3,461,804
1999	1,446,444	4,323,646	3,897,508
2000	1,372,373	4,744,650	3,867,432
2001	1,159,638	4,702,283	3,617,773

Figure 26: Summary of Conventional Project Data Liard River Basin (m^3)

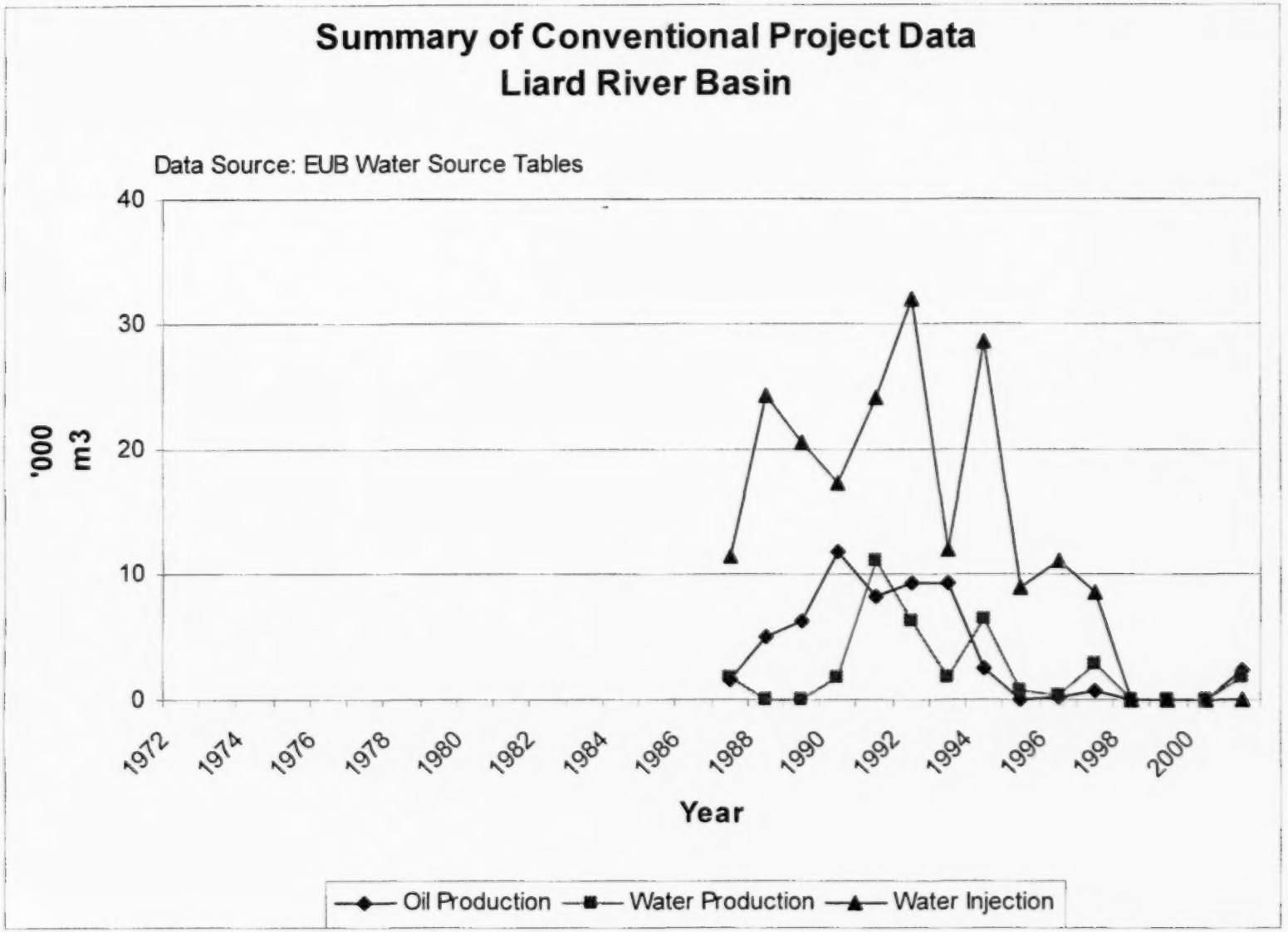

Table 26: Summary of Conventional Project Data Liard River Basin (m^3)

Year	Oil Production	Water Production	Water Injection
1972			
1973			
1974			
1975			
1976			
1977			
1978			
1979			
1980			
1981			
1982			
1983			
1984			
1985			
1986			
1987	1,672	1,796	11,422
1988	5,002	11	24,335
1989	6,272	26	20,507
1990	11,703	1,848	17,302
1991	8,294	10,986	24,141
1992	9,342	6,168	32,043
1993	9,321	1,718	12,026
1994	2,483	6,384	28,498
1995	0	787	8,911
1996	111	275	11,007
1997	627	2,861	8,609
1998	0	0	0
1999	0	0	0
2000	0	0	0
2001	2,256	1,751	0

Figure 27: Water Balance Conventional Projects Province (m^3)

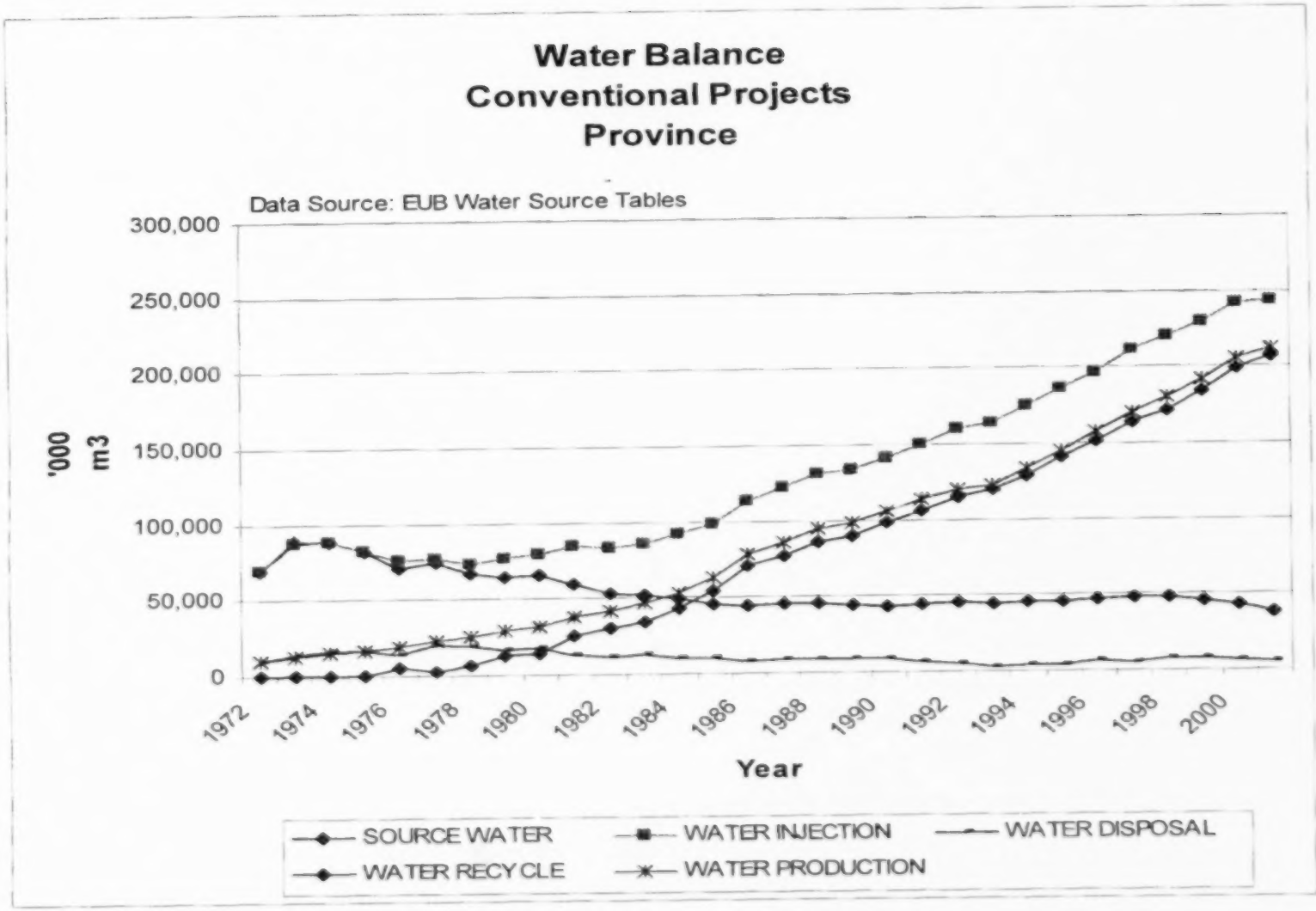

Table 27: Water Balance Conventional Projects Province (m^3)

YEAR	SOURCE WATER	WATER INJECTION	WATER RECYCLE	WATER PRODUCTION	WATER DISPOSAL
1972	69,497,060	69,159,263	-337,797	9,501,042	9,838,839
1973	88,760,866	86,643,328	-2,117,538	12,316,621	14,434,159
1974	88,445,795	87,606,144	-839,651	15,050,957	15,890,608
1975	81,957,696	81,983,532	25,836	16,975,685	16,949,849
1976	70,914,481	76,240,384	5,325,903	18,928,470	13,602,567
1977	74,589,665	77,107,804	2,518,139	22,449,444	19,931,305
1978	66,563,394	73,363,962	6,800,568	25,631,345	18,830,777
1979	64,895,774	77,510,091	12,614,317	29,197,344	16,583,027
1980	65,818,020	79,671,664	13,853,644	31,828,001	17,974,357
1981	58,893,063	84,165,963	25,272,900	38,285,209	13,012,309
1982	53,454,017	83,487,132	30,033,115	41,605,698	11,572,583
1983	51,745,842	86,259,859	34,514,017	46,649,572	12,135,555
1984	49,091,135	91,892,242	42,801,107	53,354,138	10,553,031
1985	44,765,298	98,488,622	53,723,324	63,188,994	9,465,670
1986	43,657,670	113,725,671	70,068,001	77,663,961	7,595,960
1987	45,251,417	122,706,262	77,454,845	85,803,246	8,348,401
1988	44,941,013	130,974,895	86,033,882	94,628,361	8,594,479
1989	43,894,294	133,477,038	89,582,744	97,961,433	8,378,689
1990	42,625,889	140,624,060	97,998,171	106,211,901	8,213,730
1991	43,539,478	150,039,098	106,499,620	113,196,391	6,696,771
1992	45,596,512	159,752,711	114,156,199	119,487,644	5,331,445
1993	44,504,452	164,094,317	119,589,865	122,468,298	2,878,433
1994	46,004,842	174,832,957	128,828,115	133,005,404	4,177,289
1995	45,671,574	186,248,402	140,576,828	144,396,402	3,819,574
1996	46,380,667	197,139,461	150,758,794	157,000,304	6,241,510
1997	47,589,408	211,895,288	164,305,880	169,707,893	5,402,013
1998	48,311,338	220,133,156	171,821,818	179,893,826	8,072,008
1999	45,982,865	229,995,138	184,012,273	191,323,204	7,310,931
2000	42,404,296	241,667,033	199,262,737	205,774,476	6,511,739
2001	37,292,312	243,415,291	206,122,979	211,190,675	5,067,696

Figure 28: Water Balance Conventional Projects White Zone (m^3)

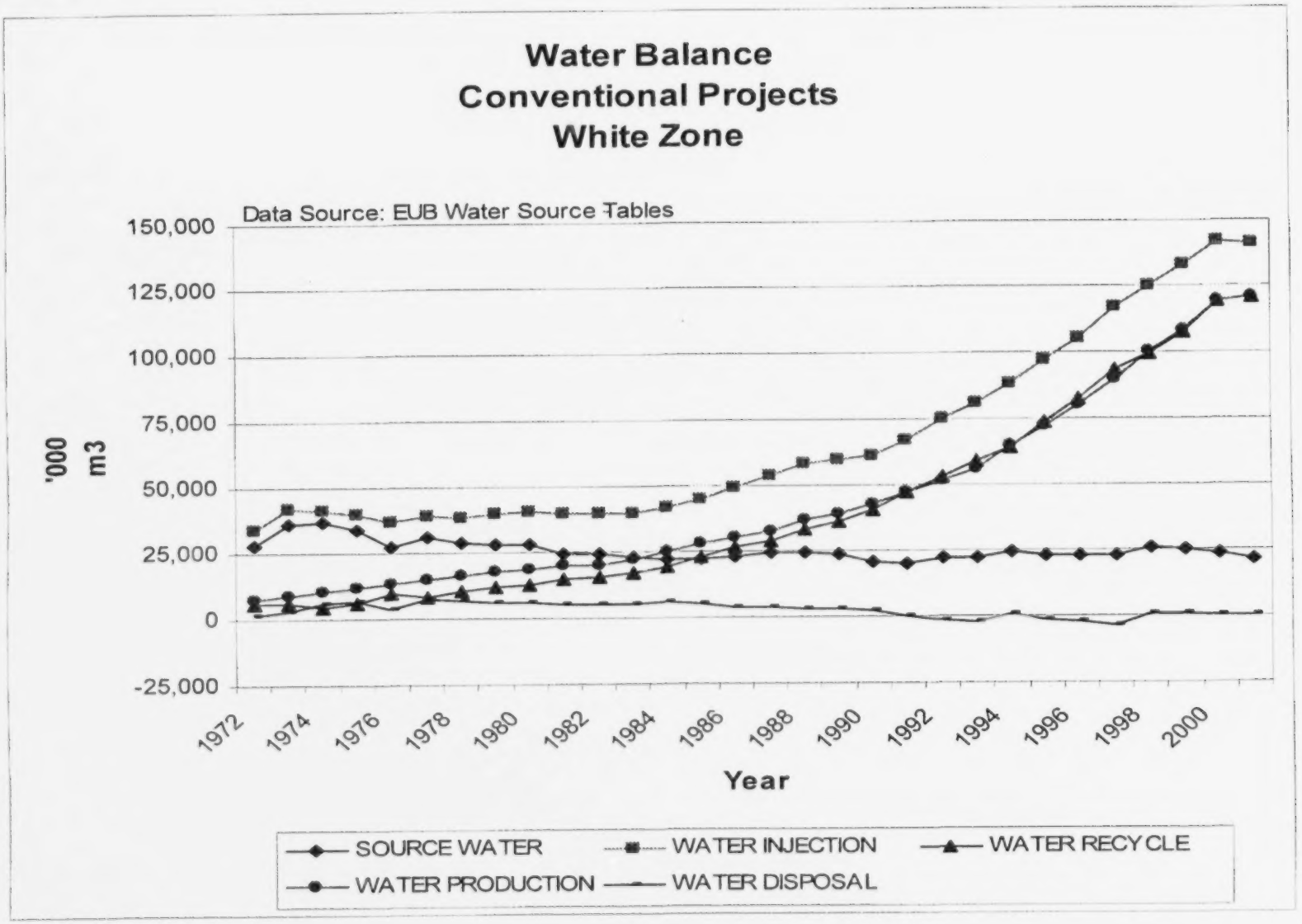

Table 28: Water Balance Conventional Projects White Zone (m^3)

YEAR	SOURCE WATER	WATER INJECTION	WATER RECYCLE	WATER PRODUCTION	WATER DISPOSAL
1972	27,641,521	33,572,491	5,930,971	7,049,974	1,119,003
1973	35,951,113	41,551,985	5,600,872	8,892,298	3,291,426
1974	36,867,401	41,459,774	4,592,373	10,472,367	5,879,994
1975	34,101,059	39,773,099	5,672,040	12,014,724	6,342,683
1976	27,431,260	36,635,286	9,204,026	12,958,407	3,754,381
1977	30,826,520	38,715,943	7,889,422	14,888,240	6,998,818
1978	28,399,241	38,368,047	9,968,806	16,459,980	6,491,174
1979	28,094,631	39,747,510	11,652,879	17,842,775	6,189,897
1980	27,937,399	40,647,638	12,710,239	18,587,634	5,877,396
1981	24,476,296	39,347,508	14,871,212	19,705,863	4,834,651
1982	24,625,371	39,754,241	15,128,870	19,956,744	4,827,873
1983	23,034,111	40,037,721	17,003,611	22,333,429	5,329,818
1984	22,395,608	41,821,157	19,425,549	25,175,191	5,749,642
1985	22,097,251	44,887,422	22,790,171	27,692,881	4,902,709
1986	22,885,700	49,419,007	26,533,307	30,190,953	3,657,646
1987	24,535,493	53,544,507	29,009,015	32,605,653	3,596,639
1988	24,365,512	57,765,524	33,400,012	36,487,388	3,087,376
1989	23,352,624	59,424,813	36,072,189	38,678,157	2,605,968
1990	20,797,569	61,073,459	40,275,890	42,458,491	2,182,601
1991	20,187,039	67,210,720	47,023,681	47,301,518	277,838
1992	21,856,888	74,783,235	52,926,347	51,822,456	-1,103,891
1993	22,118,112	80,634,218	58,516,106	56,025,336	-2,490,770
1994	24,293,753	88,551,750	64,257,997	64,723,738	465,741
1995	22,863,457	96,743,855	73,880,398	72,382,614	-1,497,784
1996	22,716,428	104,857,792	82,141,365	80,205,414	-1,935,951
1997	23,063,191	116,561,026	93,497,835	89,664,857	-3,832,978
1998	25,532,240	124,745,651	99,213,411	99,733,300	519,889
1999	25,279,024	132,928,220	107,649,196	108,341,547	692,351
2000	23,336,400	142,144,088	118,807,688	118,858,721	51,032
2001	21,049,097	141,355,837	120,306,740	120,417,304	110,564

Figure 29: Water Balance Conventional Projects Green Zone (m^3)

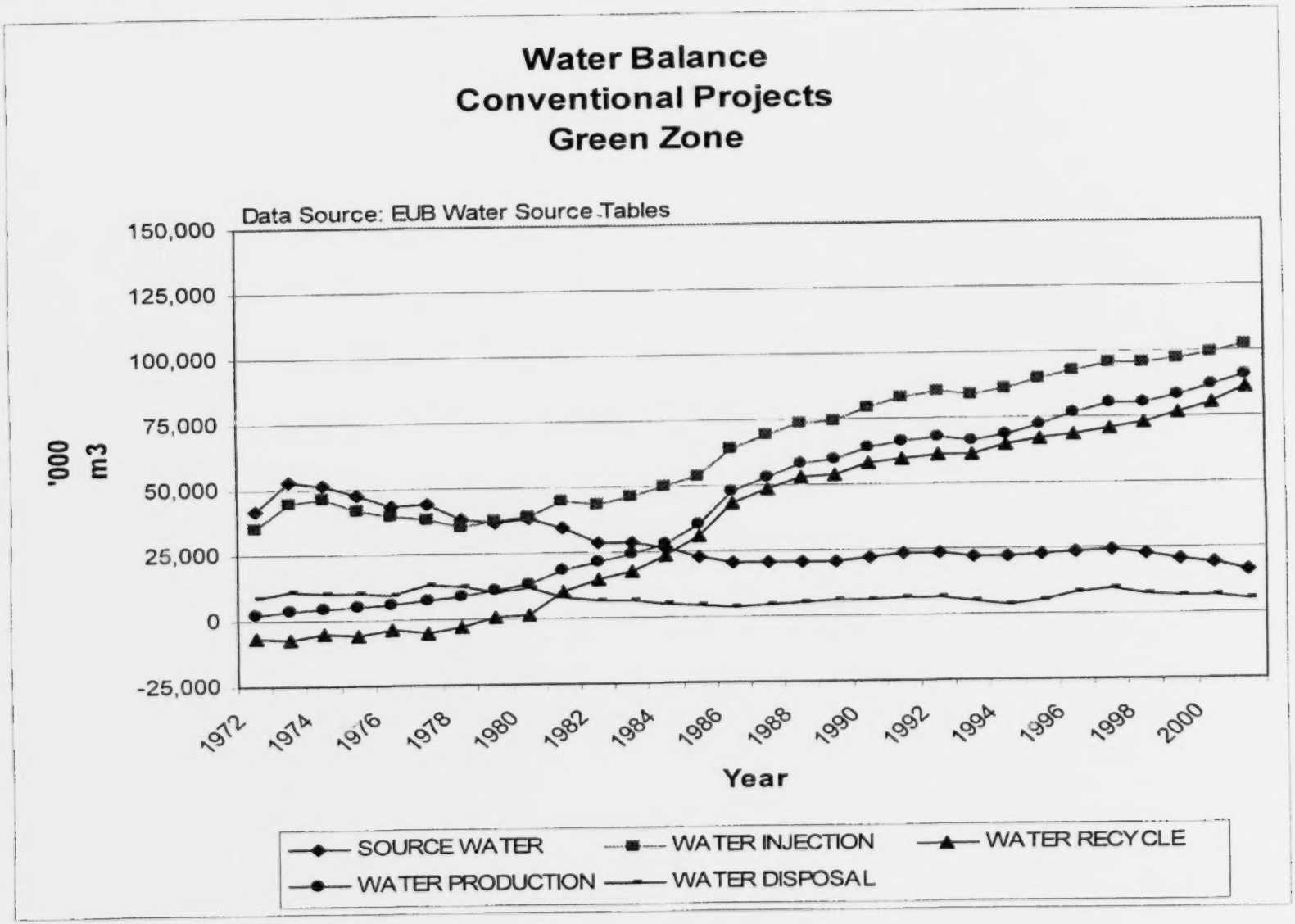

Table 29: Water Balance Conventional Projects Green Zone (m^3)

YEAR	SOURCE WATER	WATER INJECTION	WATER RECYCLE	WATER PRODUCTION	WATER DISPOSAL
1972	41,855,539	35,586,772	-6,268,767	2,451,068	8,719,836
1973	52,809,753	45,091,343	-7,718,410	3,424,322	11,142,733
1974	51,578,394	46,146,369	-5,432,024	4,578,590	10,010,614
1975	47,856,637	42,210,433	-5,646,204	4,960,962	10,607,166
1976	43,483,221	39,605,098	-3,878,123	5,970,064	9,848,186
1977	43,763,145	38,391,862	-5,371,283	7,561,203	12,932,486
1978	38,164,153	34,995,915	-3,168,238	9,171,365	12,339,603
1979	36,801,143	37,762,581	961,438	11,354,569	10,393,131
1980	37,880,621	39,024,027	1,143,405	13,240,367	12,096,962
1981	34,416,767	44,818,455	10,401,688	18,579,346	8,177,658
1982	28,828,647	43,732,891	14,904,245	21,648,955	6,744,710
1983	28,711,732	46,222,137	17,510,406	24,316,143	6,805,738
1984	26,695,527	50,071,085	23,375,558	28,178,947	4,803,390
1985	22,668,047	53,601,200	30,933,153	35,496,114	4,562,961
1986	20,771,970	64,306,664	43,534,694	47,473,008	3,938,314
1987	20,715,924	69,161,755	48,445,831	53,197,593	4,751,762
1988	20,575,501	73,209,371	52,633,870	58,140,972	5,507,103
1989	20,541,670	74,052,225	53,510,555	59,283,276	5,772,721
1990	21,828,320	79,550,601	57,722,281	63,753,410	6,031,129
1991	23,352,439	82,828,378	59,475,939	65,894,872	6,418,933
1992	23,739,623	84,969,476	61,229,853	67,665,188	6,435,335
1993	22,386,339	83,460,099	61,073,760	66,442,962	5,369,203
1994	21,711,089	86,281,207	64,570,119	68,281,667	3,711,548
1995	22,808,117	89,504,547	66,696,430	72,013,788	5,317,358
1996	23,664,239	92,281,669	68,617,430	76,794,890	8,177,460
1997	24,526,217	95,334,262	70,808,045	80,043,036	9,234,991
1998	22,779,099	95,387,506	72,608,407	80,160,526	7,552,119
1999	20,703,842	97,066,919	76,363,077	82,981,657	6,618,580
2000	19,067,896	99,522,945	80,455,049	86,915,755	6,460,706
2001	16,243,216	102,059,454	85,816,239	90,773,371	4,957,133

Figure 30: Water Balance Conventional Projects Athabasca River Basin (m^3)

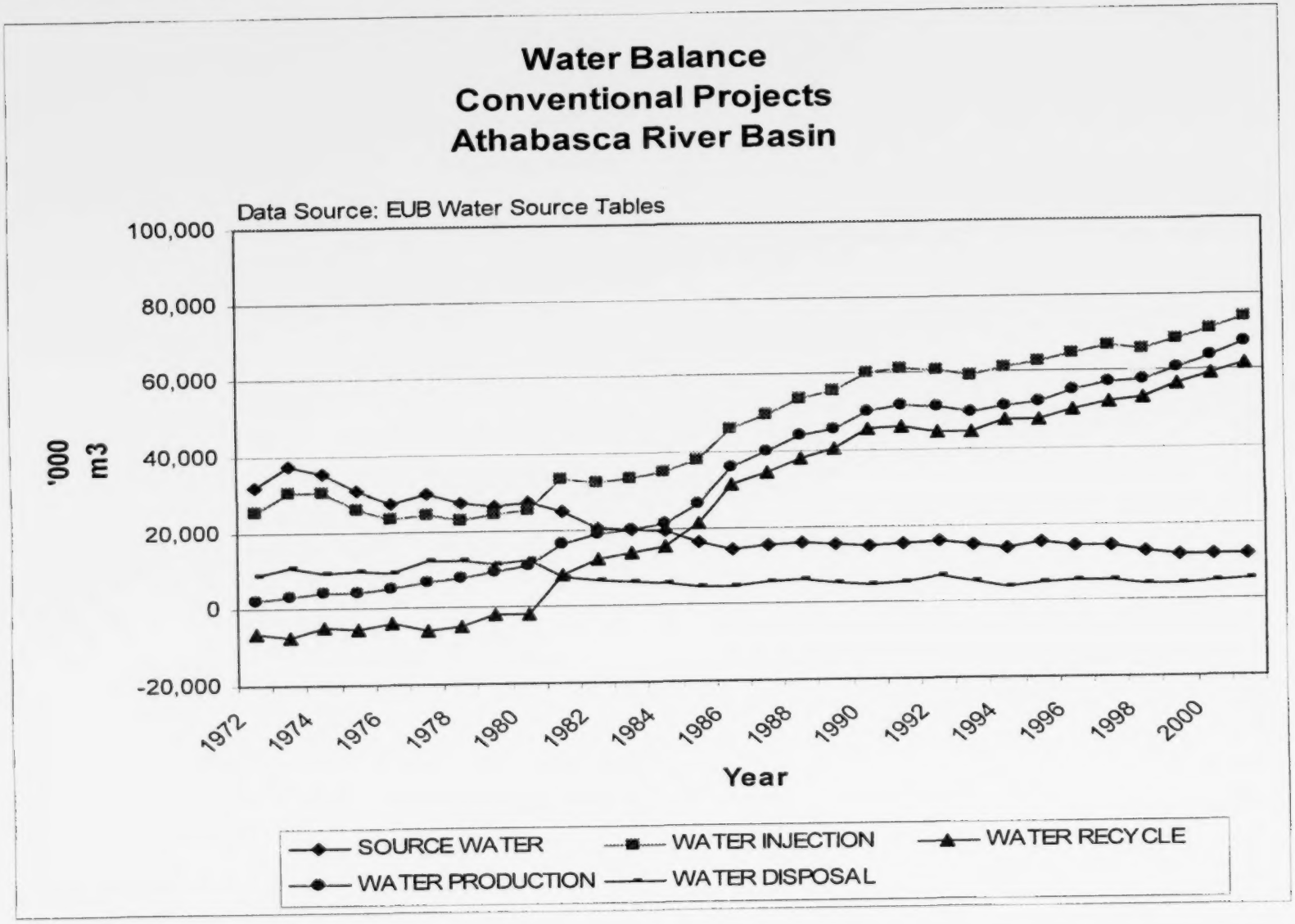

Table 30: Water Balance Conventional Projects Athabasca River Basin (m^3)

YEAR	SOURCE WATER	WATER INJECTION	WATER RECYCLE	WATER PRODUCTION	WATER DISPOSAL
1972	31,733,153	25,226,644	-6,506,509	2,337,245	8,843,754
1973	37,605,546	30,209,233	-7,396,313	3,183,724	10,580,037
1974	35,274,857	30,217,768	-5,057,089	4,178,480	9,235,569
1975	31,027,874	25,825,477	-5,202,397	4,450,842	9,653,239
1976	27,339,180	23,496,252	-3,842,928	5,220,963	9,063,891
1977	30,138,600	24,253,890	-5,884,710	6,526,111	12,410,821
1978	27,628,150	22,914,930	-4,713,220	7,572,335	12,285,554
1979	26,157,235	24,287,848	-1,869,387	9,310,882	11,180,269
1980	27,178,096	25,366,100	-1,811,996	10,568,832	12,380,828
1981	24,968,304	33,214,866	8,246,562	16,146,904	7,900,341
1982	20,182,321	32,415,909	12,233,588	18,903,954	6,670,366
1983	19,743,716	33,392,799	13,649,083	19,845,090	6,196,007
1984	19,434,707	34,790,444	15,355,737	21,165,618	5,809,882
1985	16,409,125	37,858,312	21,449,187	26,177,824	4,728,637
1986	14,274,503	45,805,852	31,531,349	36,062,753	4,531,404
1987	15,068,640	49,347,199	34,278,560	39,771,584	5,493,024
1988	15,822,786	53,666,159	37,843,373	44,103,843	6,260,470
1989	15,417,724	55,871,140	40,453,416	45,603,622	5,150,206
1990	14,621,080	60,032,004	45,410,924	50,305,771	4,894,846
1991	15,091,234	61,125,464	46,034,229	51,472,556	5,438,327
1992	15,821,038	60,580,920	44,759,882	51,333,675	6,573,793
1993	14,913,468	59,201,289	44,287,821	49,497,737	5,209,916
1994	13,986,620	61,428,484	47,441,864	50,930,510	3,488,646
1995	15,394,702	62,933,985	47,539,283	52,013,577	4,474,294
1996	14,407,885	64,638,586	50,230,702	55,293,306	5,062,604
1997	14,308,920	66,487,058	52,178,138	57,370,137	5,191,999
1998	12,600,043	65,779,783	53,179,740	57,427,161	4,247,422
1999	11,563,564	68,162,554	56,598,990	60,686,195	4,087,205
2000	11,693,301	70,776,662	59,083,362	63,723,633	4,640,271
2001	11,804,111	73,694,285	61,890,174	67,033,153	5,142,979

Figure 31: Water Balance Conventional Projects Hay River Basin (m^3)

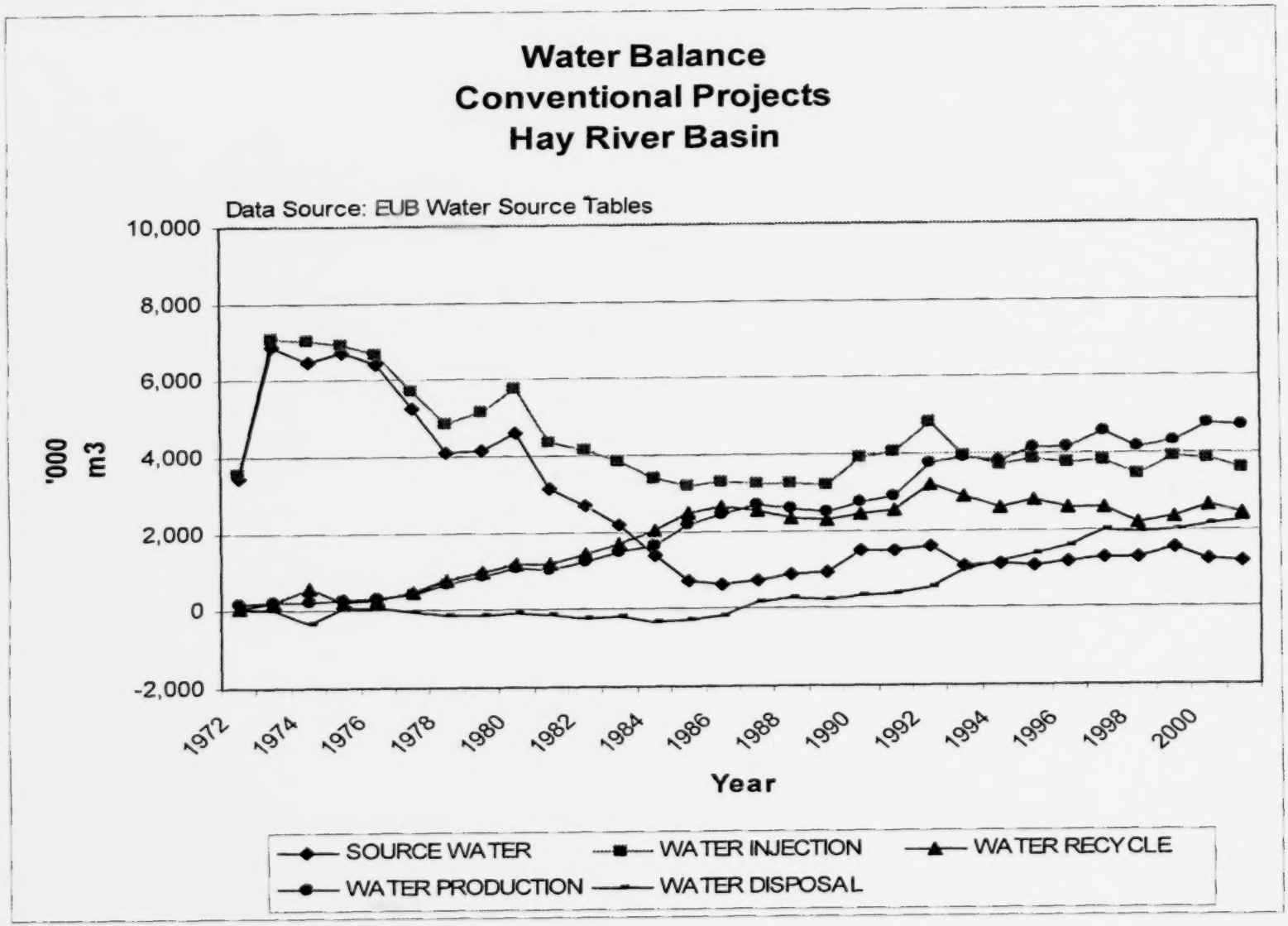

Table 31: Water Balance Conventional Projects Hay River Basin (m^3)

YEAR	SOURCE WATER	WATER INJECTION	WATER RECYCLE	WATER PRODUCTION	WATER DISPOSAL
1972	3,459,184	3,522,699	63,515	154,504	90,989
1973	6,864,354	7,093,244	228,890	226,787	-2,104
1974	6,454,535	7,036,802	582,267	228,097	-354,170
1975	6,707,197	6,918,212	211,015	283,126	72,110
1976	6,409,424	6,669,737	260,313	305,889	45,576
1977	5,262,063	5,713,365	451,301	409,971	-41,331
1978	4,100,942	4,870,876	769,934	655,898	-114,037
1979	4,175,981	5,175,863	999,882	854,156	-145,726
1980	4,586,402	5,771,805	1,185,403	1,078,733	-106,670
1981	3,148,443	4,330,714	1,182,272	1,041,447	-140,825
1982	2,690,780	4,130,236	1,439,457	1,220,573	-218,884
1983	2,205,273	3,865,228	1,659,955	1,490,970	-168,985
1984	1,382,027	3,397,293	2,015,266	1,655,051	-360,215
1985	737,623	3,211,752	2,474,129	2,194,152	-279,977
1986	638,606	3,298,897	2,660,291	2,454,547	-205,744
1987	734,011	3,253,153	2,519,142	2,710,035	190,893
1988	878,371	3,224,758	2,346,388	2,596,443	250,055
1989	911,155	3,215,405	2,304,249	2,498,812	194,563
1990	1,503,887	3,923,584	2,419,697	2,738,487	318,790
1991	1,492,685	4,051,944	2,559,259	2,912,881	353,622
1992	1,592,974	4,795,145	3,202,171	3,736,300	534,129
1993	1,071,642	3,969,869	2,898,227	3,892,467	994,240
1994	1,109,452	3,708,916	2,599,463	3,788,340	1,188,877
1995	1,070,875	3,854,808	2,783,933	4,157,866	1,373,933
1996	1,161,658	3,761,160	2,599,501	4,172,083	1,572,582
1997	1,252,120	3,823,072	2,570,952	4,559,233	1,988,281
1998	1,258,646	3,461,804	2,203,158	4,153,326	1,950,168
1999	1,543,775	3,897,508	2,353,734	4,323,646	1,969,913
2000	1,246,472	3,867,432	2,620,959	4,744,650	2,123,690
2001	1,162,202	3,617,773	2,455,571	4,702,283	2,246,713

Figure 32: Water Balance Conventional Projects Milk River Basin (m^3)

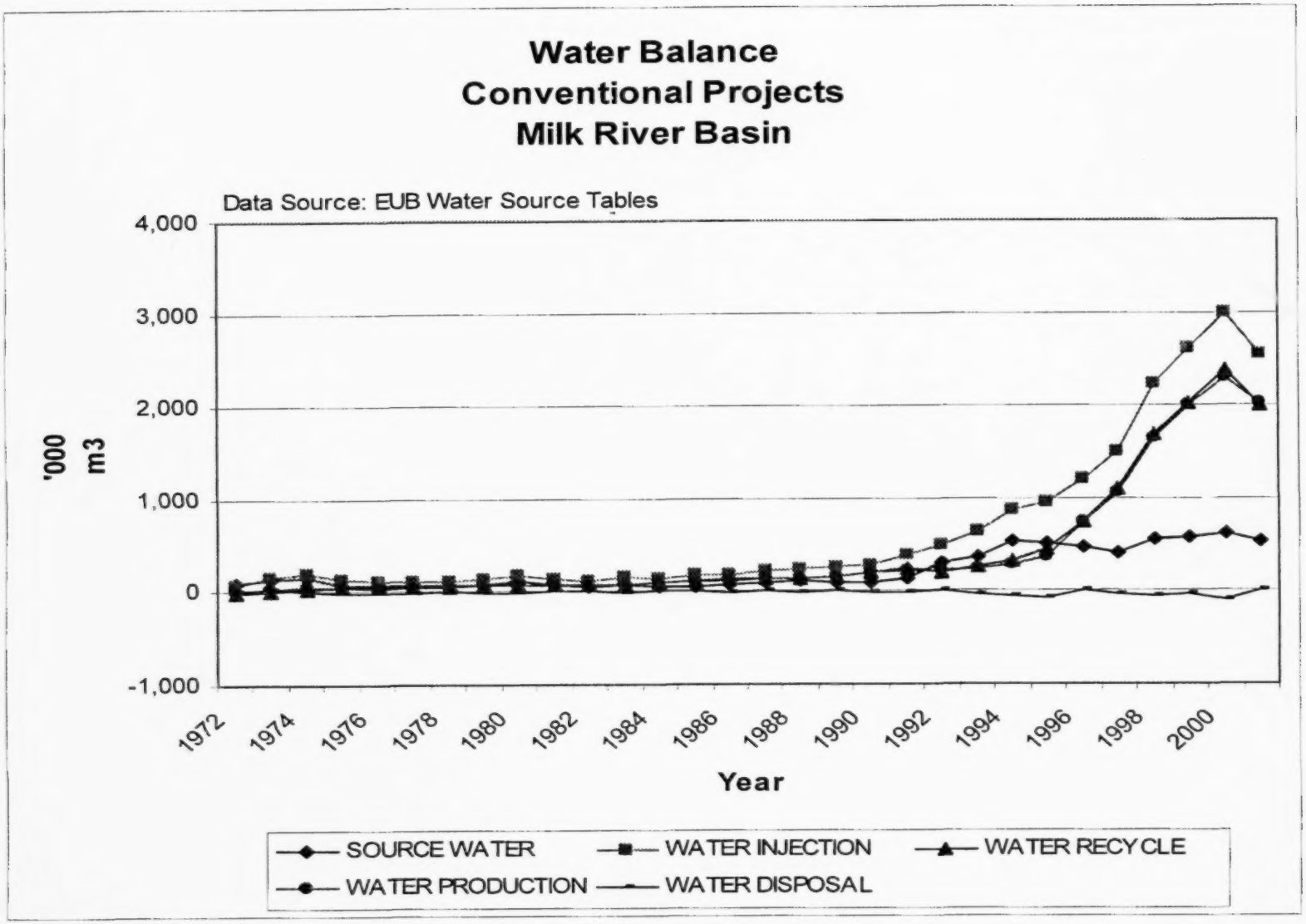

Table 32: Water Balance Conventional Projects Milk River Basin (m^3)

YEAR	SOURCE WATER	WATER INJECTION	WATER RECYCLE	WATER PRODUCTION	WATER DISPOSAL
1972	85,915	80,357	-5,558	10,994	16,552
1973	138,203	152,511	14,309	33,674	19,365
1974	162,070	193,458	31,388	43,957	12,569
1975	72,258	128,300	56,042	46,032	-10,009
1976	79,769	121,033	41,264	37,081	-4,183
1977	62,321	106,798	44,477	41,652	-2,826
1978	60,999	110,985	49,986	49,453	-532
1979	75,064	141,869	66,805	61,581	-5,224
1980	104,270	181,967	77,696	70,024	-7,672
1981	67,078	142,358	75,280	75,603	322
1982	49,309	111,905	62,596	61,481	-1,116
1983	76,006	149,692	73,686	71,105	-2,581
1984	54,607	144,332	89,725	93,353	3,628
1985	57,574	176,366	118,792	118,597	-195
1986	61,202	185,965	124,762	121,943	-2,819
1987	100,399	227,972	127,573	127,091	-482
1988	107,887	246,674	138,788	132,824	-5,964
1989	97,056	255,537	158,481	156,533	-1,948
1990	86,862	289,143	202,280	190,382	-11,899
1991	141,214	381,078	239,864	219,769	-20,095
1992	295,739	499,013	203,275	208,959	5,684
1993	369,797	628,342	258,545	232,375	-26,170
1994	534,250	867,449	333,199	289,017	-44,182
1995	511,584	951,554	439,970	373,000	-66,970
1996	461,380	1,213,251	751,872	751,805	-67
1997	404,329	1,502,260	1,097,931	1,055,148	-42,783
1998	546,419	2,242,997	1,696,578	1,644,583	-51,995
1999	577,373	2,608,262	2,030,889	2,003,022	-27,867
2000	615,578	3,001,275	2,385,697	2,296,030	-89,668
2001	539,101	2,548,206	2,009,104	2,016,593	7,489

Figure 33: Water Balance Conventional Projects North Saskatchewan R. Basin (m^3)

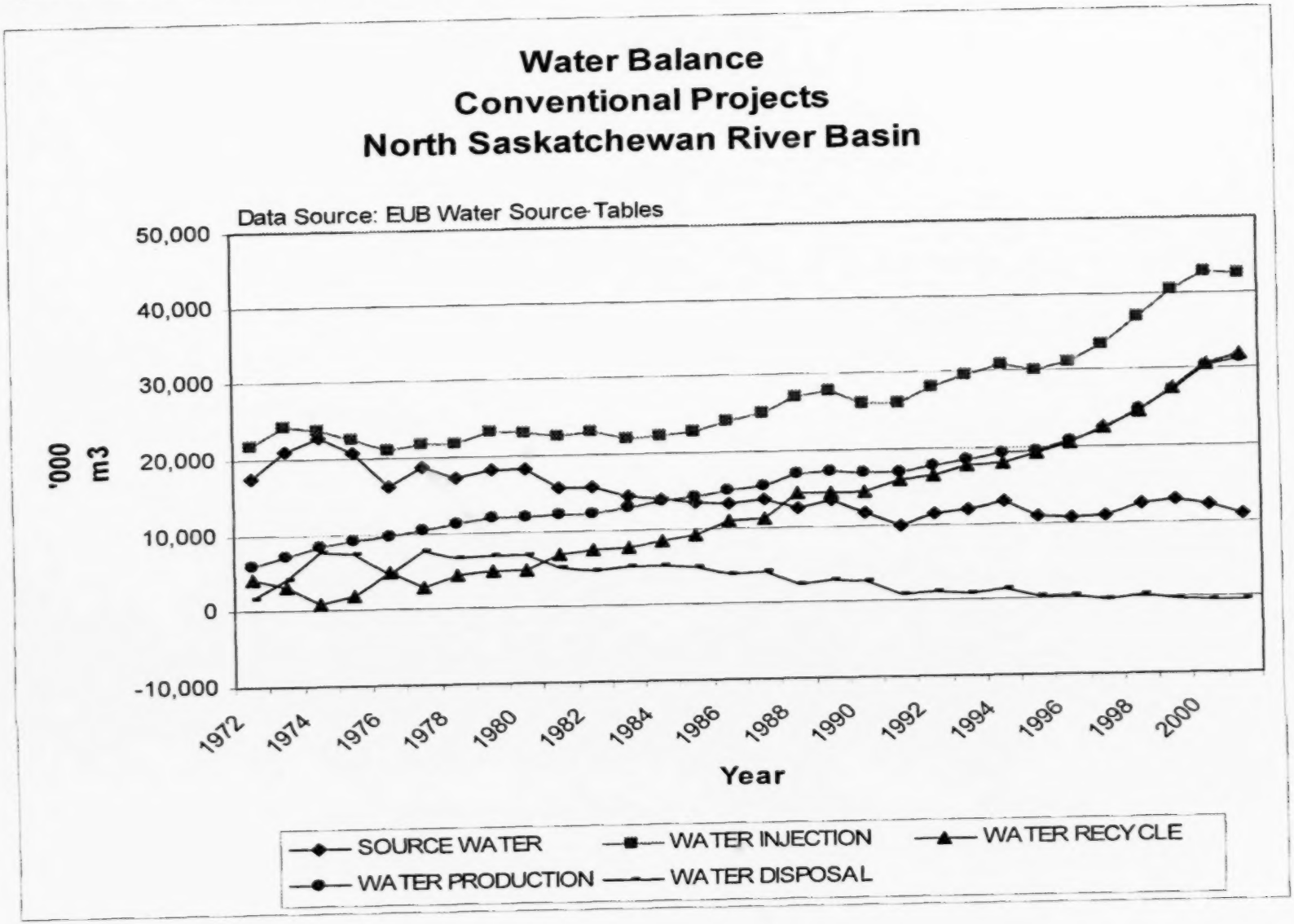

Table 33: Water Balance Conventional Projects North Saskatchewan R. Basin (m^3)

YEAR	SOURCE WATER	WATER INJECTION	WATER RECYCLE	WATER PRODUCTION	WATER DISPOSAL
1972	17,437,571	21,656,338	4,218,767	5,899,371	1,680,604
1973	21,126,777	24,322,167	3,195,390	7,241,170	4,045,780
1974	22,876,953	23,690,881	813,929	8,395,492	7,581,564
1975	20,685,408	22,452,358	1,766,951	9,261,456	7,494,505
1976	16,180,054	21,076,279	4,896,225	9,635,533	4,739,308
1977	18,864,879	21,643,239	2,778,360	10,407,399	7,629,039
1978	17,266,789	21,755,512	4,488,723	11,186,182	6,697,459
1979	18,289,915	23,199,969	4,910,054	11,875,011	6,964,958
1980	18,164,245	23,093,061	4,928,816	11,846,480	6,917,664
1981	15,750,137	22,613,583	6,863,446	12,064,826	5,201,380
1982	15,592,769	23,095,775	7,503,006	12,228,669	4,725,663
1983	14,493,844	22,118,648	7,624,805	12,850,302	5,225,497
1984	13,824,817	22,257,397	8,432,581	13,611,580	5,178,999
1985	13,521,011	22,790,114	9,269,103	14,196,752	4,927,649
1986	13,097,524	24,115,865	11,018,341	14,883,896	3,865,555
1987	13,803,554	25,088,733	11,285,179	15,393,341	4,108,162
1988	12,482,679	27,017,866	14,535,187	17,007,514	2,472,328
1989	13,346,977	27,711,253	14,364,276	17,199,082	2,834,806
1990	11,647,806	26,044,699	14,396,893	17,055,165	2,658,272
1991	9,944,445	25,943,022	15,998,577	16,853,379	854,802
1992	11,475,204	28,032,061	16,556,857	17,630,306	1,073,449
1993	11,887,934	29,595,495	17,707,562	18,436,822	729,260
1994	12,948,639	30,872,839	17,924,201	19,335,145	1,410,944
1995	10,924,203	30,176,423	19,252,220	19,498,772	246,552
1996	10,562,472	31,078,279	20,515,807	20,827,948	312,141
1997	10,936,639	33,412,903	22,476,264	22,276,872	-199,392
1998	12,469,869	36,965,922	24,496,053	24,871,968	375,914
1999	12,930,245	40,382,987	27,452,742	27,343,752	-108,990
2000	12,078,657	42,744,480	30,665,822	30,257,857	-407,965
2001	10,803,525	42,558,365	31,754,840	31,274,333	-480,507

Figure 34: Water Balance Conventional Projects Peace River Basin (m^3)

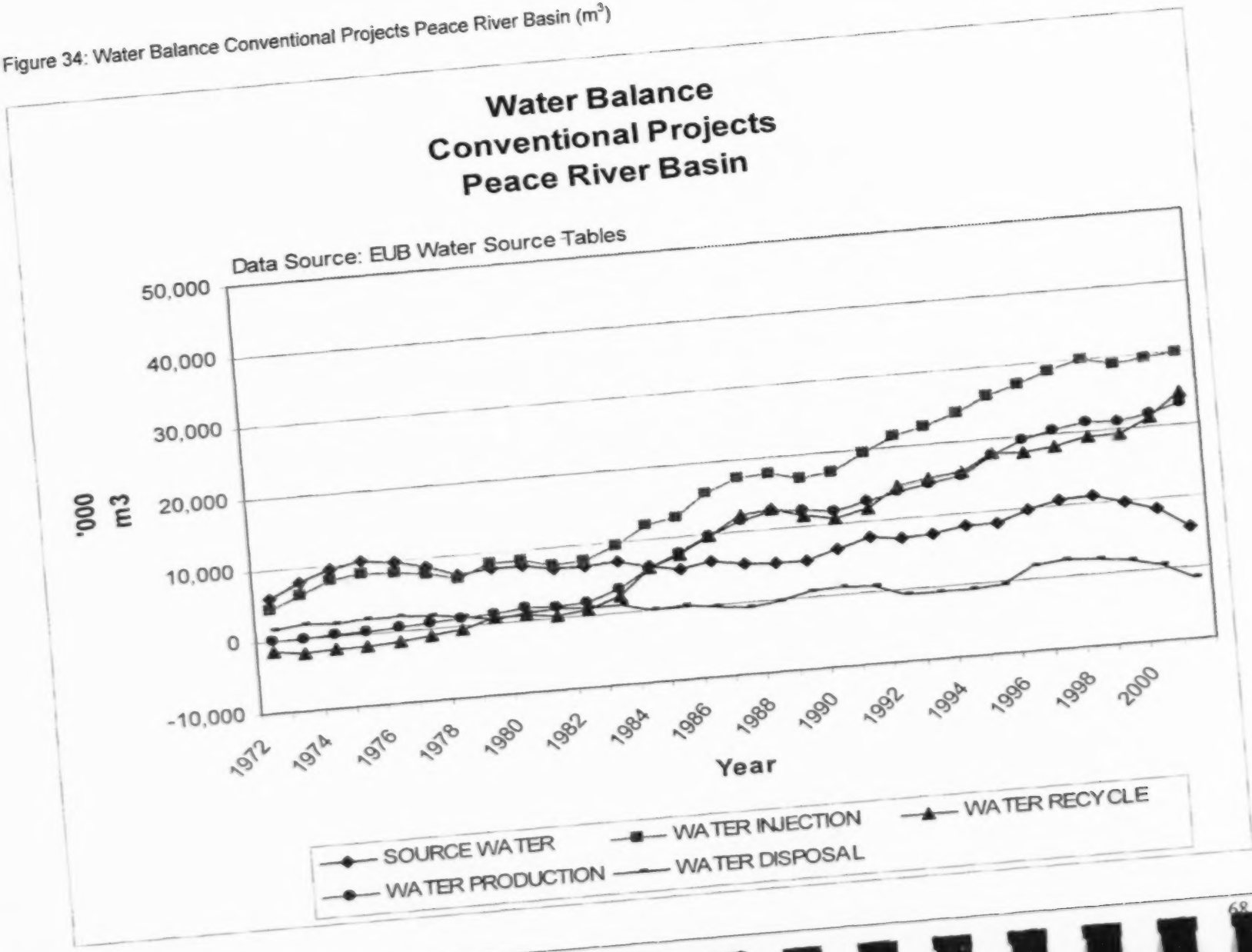

Table 34: Water Balance Conventional Projects Peace River Basin (m^3)

YEAR	SOURCE WATER	WATER INJECTION	WATER RECYCLE	WATER PRODUCTION	WATER DISPOSAL
1972	5,940,151	4,455,463	-1,484,688	47,688	1,532,376
1973	7,916,579	6,035,796	-1,880,782	119,329	2,000,111
1974	9,375,268	7,809,782	-1,565,487	291,830	1,857,317
1975	10,240,547	8,447,040	-1,793,507	383,992	2,177,498
1976	9,725,803	8,226,071	-1,499,731	612,123	2,111,855
1977	8,536,803	7,528,073	-1,008,729	790,243	1,798,972
1978	7,021,925	6,692,045	-329,880	1,120,154	1,450,034
1979	7,540,307	8,285,995	745,688	1,406,917	661,230
1980	7,634,408	8,366,721	732,312	1,832,128	1,099,816
1981	7,014,284	7,323,155	308,870	1,598,591	1,289,720
1982	6,972,944	7,691,777	718,834	1,843,207	1,124,373
1983	7,025,372	9,432,511	2,407,140	3,444,560	1,037,420
1984	6,177,512	12,004,902	5,827,391	5,935,819	108,429
1985	5,393,095	12,779,912	7,386,817	7,756,586	369,770
1986	6,119,764	15,757,139	9,637,376	9,593,373	-44,002
1987	5,371,681	17,450,590	12,078,909	11,478,769	-600,140
1988	5,138,034	17,802,755	12,664,721	12,405,626	-259,095
1989	5,227,607	16,613,877	11,386,270	12,233,082	846,812
1990	6,499,303	17,173,973	10,674,670	11,746,867	1,072,197
1991	7,698,651	19,436,703	11,738,052	12,617,590	879,538
1992	7,211,407	21,586,911	14,375,504	13,756,139	-619,365
1993	7,381,123	22,540,294	15,159,171	14,361,064	-798,107
1994	8,243,890	24,021,288	15,777,398	15,112,571	-664,827
1995	8,097,439	26,170,347	18,072,908	17,728,008	-344,900
1996	9,607,536	27,376,551	17,769,015	19,521,132	1,752,117
1997	10,644,331	28,871,128	18,226,797	20,540,625	2,313,828
1998	10,866,224	30,118,769	19,252,545	21,349,114	2,096,569
1999	9,640,969	28,984,751	19,343,783	21,060,910	1,717,128
2000	8,436,252	29,614,330	21,178,078	21,802,160	624,082
2001	5,507,795	29,958,469	24,450,674	23,113,806	-1,336,869

Figure 35: Water Balance Conventional Projects South Saskatchewan R. Basin (m^3)

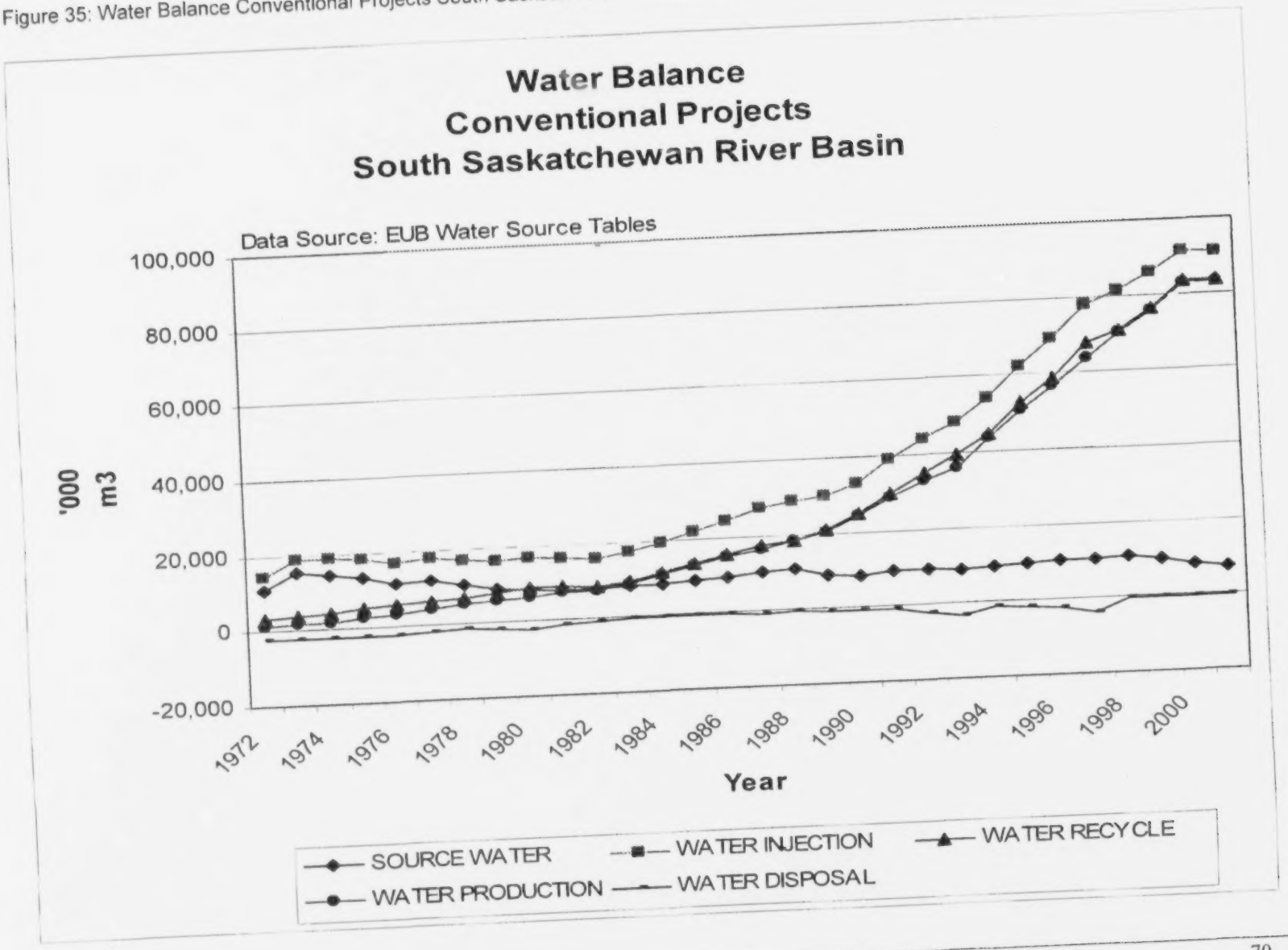

Table 35: Water Balance Conventional Projects South Saskatchewan R. Basin (m^3)

YEAR	SOURCE WATER	WATER INJECTION	WATER RECYCLE	WATER PRODUCTION	WATER DISPOSAL
1972	10,841,087	14,217,763	3,376,676	1,051,241	-2,325,436
1973	15,109,408	18,830,376	3,720,968	1,511,937	-2,209,031
1974	14,302,113	18,657,454	4,355,341	1,913,101	-2,442,240
1975	13,224,413	18,212,145	4,987,733	2,550,238	-2,437,494
1976	11,180,251	16,651,012	5,470,761	3,116,881	-2,353,879
1977	11,724,999	17,862,440	6,137,441	4,274,069	-1,863,371
1978	10,484,590	17,019,615	6,535,026	5,047,324	-1,487,701
1979	8,657,272	16,418,547	7,761,275	5,688,796	-2,072,479
1980	8,150,598	16,892,011	8,741,413	6,431,804	-2,309,609
1981	7,944,817	16,541,288	8,596,471	7,357,840	-1,238,631
1982	7,965,895	16,041,529	8,075,634	7,347,814	-727,820
1983	8,201,633	17,300,981	9,099,347	8,947,544	-151,803
1984	8,217,466	19,297,873	11,080,408	10,892,717	-187,691
1985	8,646,870	21,672,166	13,025,296	12,745,083	-280,213
1986	9,466,071	24,561,953	15,095,882	14,547,448	-548,434
1987	10,173,132	27,327,193	17,154,061	16,320,631	-833,430
1988	10,511,257	28,992,348	18,481,091	18,382,100	-98,991
1989	8,893,774	29,789,319	20,895,545	20,270,275	-625,270
1990	8,266,950	33,143,355	24,876,404	24,173,382	-703,022
1991	9,171,248	39,076,745	29,905,498	29,109,230	-796,268
1992	9,182,861	44,226,619	35,043,758	32,816,097	-2,227,661
1993	8,877,986	48,147,002	39,269,017	36,046,116	-3,222,900
1994	9,166,983	53,905,483	44,738,500	43,543,437	-1,195,062
1995	9,672,771	62,152,374	52,479,603	50,624,392	-1,855,211
1996	10,179,736	69,060,627	58,880,891	56,433,757	-2,447,135
1997	10,043,070	77,790,259	67,747,189	63,903,017	-3,844,172
1998	10,570,138	81,563,882	70,993,744	70,447,675	-546,069
1999	9,726,939	85,959,075	76,232,136	75,905,679	-326,457
2000	8,334,035	91,662,855	83,328,819	82,950,147	-378,672
2001	7,475,578	91,038,193	83,562,616	83,048,757	-513,859

Figure 36: Water Balance Conventional Projects Liard River Basin (m^3)

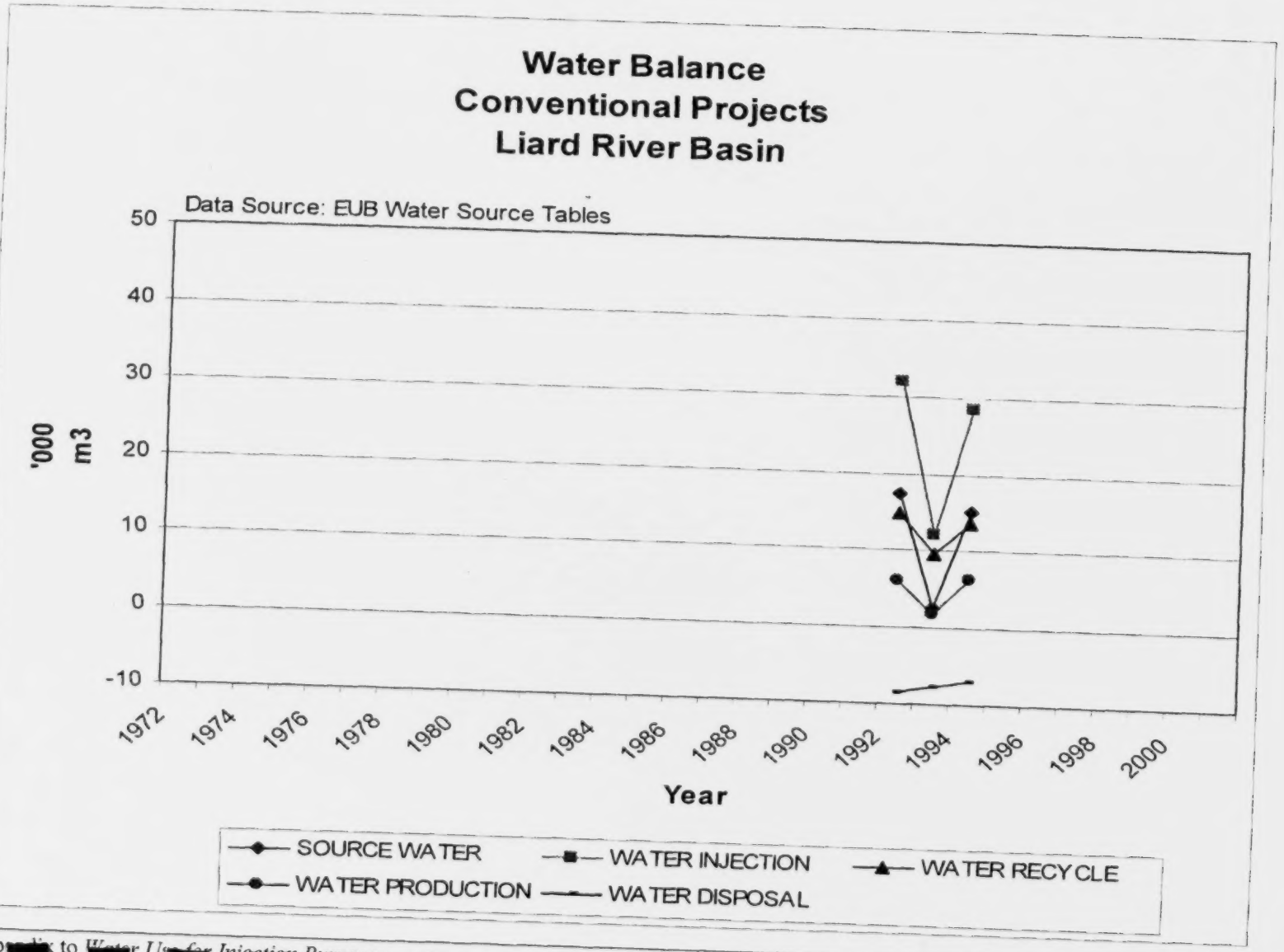

Table 36: Water Balance Conventional Projects Liard River Basin (m^3)

YEAR	SOURCE WATER	WATER INJECTION	WATER RECYCLE	WATER PRODUCTION	WATER DISPOSAL
1972					
1973					
1974					
1975					
1976					
1977					
1978					
1979					
1980					
1981					
1982					
1983					
1984					
1985					
1986					
1987					
1988					
1989					
1990					
1991					
1992	17,289	32,043	14,754	6,168	-8,586
1993	2,503	12,026	9,524	1,718	-7,806
1994	15,007	28,498	13,491	6,384	-7,107
1995					
1996					
1997					
1998					
1999					
2000					
2001					

Figure 37: Water Balance Thermal Projects Provincial (m^3)

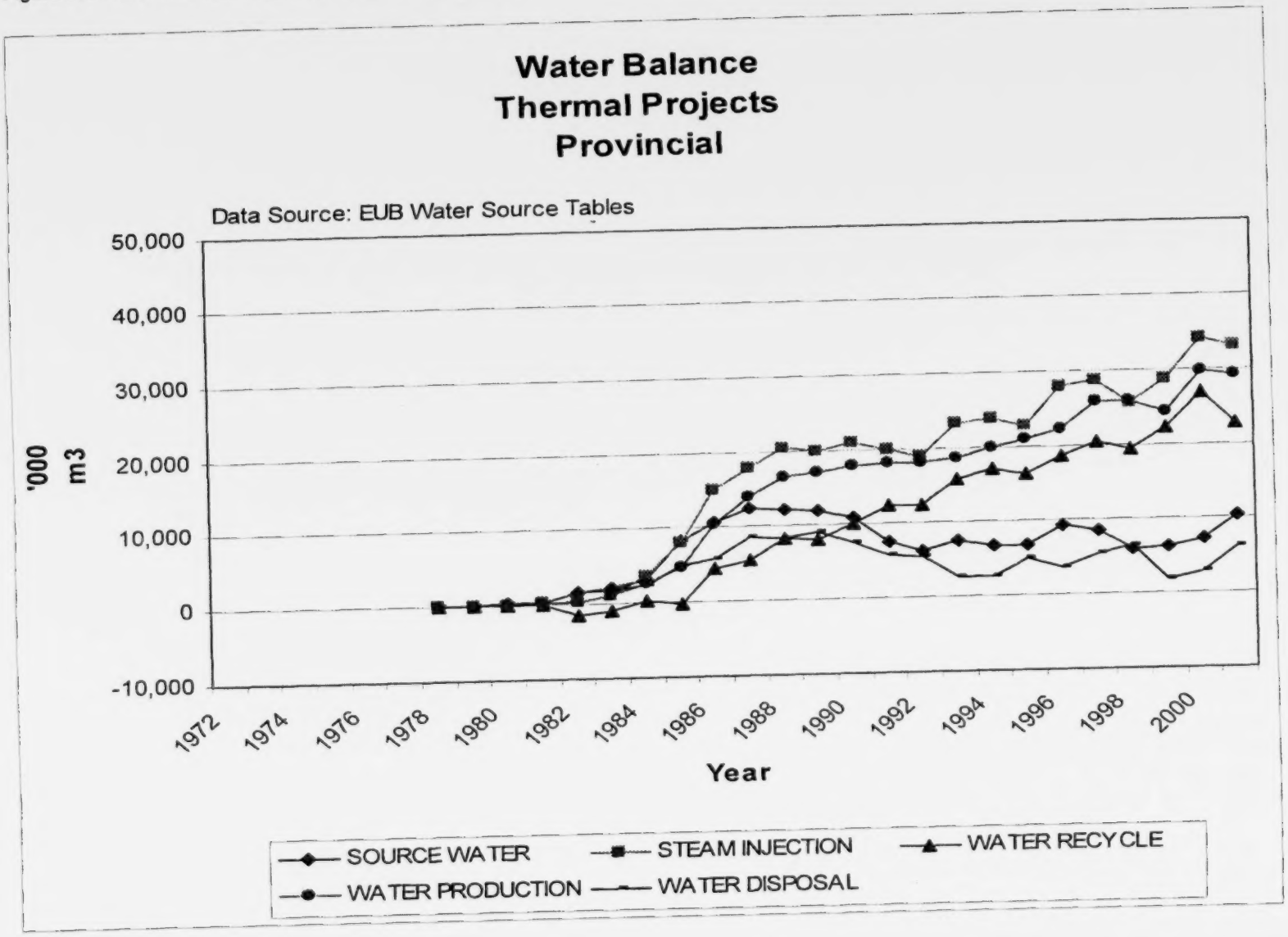

Table 37: Water Balance Thermal Projects Provincial (m^3)

YEAR	SOURCE WATER	STEAM INJECTION	WATER RECYCLE	WATER PRODUCTION	WATER DISPOSAL
1972					
1973					
1974					
1975					
1976					
1977					
1978	7,520	41,511	33,991	23,680	-10,311
1979	31,768	37,243	5,475	50,629	45,154
1980	184,318	158,381	-25,937	169,356	195,293
1981	241,098	352,557	111,459	287,486	176,027
1982	1,646,814	271,710	-1,375,104	270,904	1,646,008
1983	2,071,889	1,126,827	-945,062	967,622	1,912,684
1984	3,242,211	3,586,527	344,316	2,738,349	2,394,033
1985	8,204,679	7,953,783	-250,896	4,600,288	4,851,184
1986	10,572,638	15,097,503	4,524,865	10,232,098	5,707,233
1987	12,340,050	17,758,023	5,417,973	14,005,287	8,587,314
1988	12,237,459	20,472,212	8,234,753	16,472,766	8,238,013
1989	11,786,336	19,939,709	8,153,373	17,121,619	8,968,246
1990	10,756,378	20,909,275	10,152,897	17,744,163	7,591,266
1991	7,602,709	19,925,864	12,323,155	17,981,045	5,657,890
1992	6,300,482	18,799,458	12,498,976	17,942,700	5,443,724
1993	7,469,764	23,191,717	15,721,953	18,466,497	2,744,544
1994	6,721,779	23,827,865	17,106,087	19,765,981	2,659,895
1995	6,616,995	22,760,544	16,143,549	20,961,603	4,818,054
1996	9,334,398	27,836,255	18,501,857	22,267,742	3,765,885
1997	8,447,305	28,736,694	20,289,389	25,863,529	5,574,140
1998	6,053,784	25,536,922	19,483,138	25,864,945	6,381,807
1999	6,316,675	28,621,842	22,305,167	24,171,431	1,866,264
2000	7,241,515	34,063,138	26,821,623	29,758,025	2,936,402
2001	10,233,436	33,028,130	22,794,694	29,103,746	6,309,052

Figure 38: Water Balance Thermal Projects Peace River Basin (m^3)

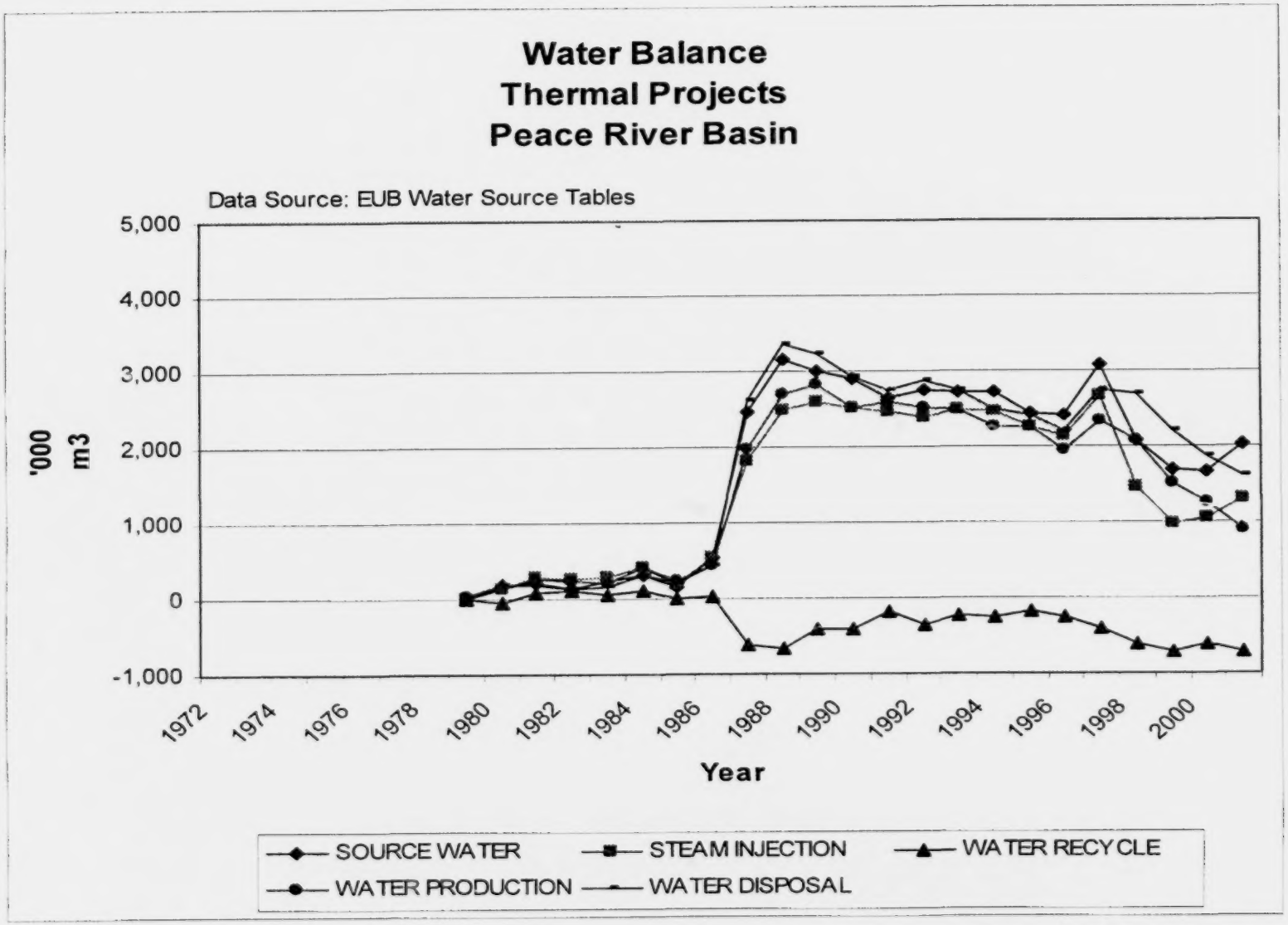

Table 38: Water Balance Thermal Projects Peace River Basin (m^3)

YEAR	SOURCE WATER	STEAM INJECTION	WATER RECYCLE	WATER PRODUCTION	WATER DISPOSAL
1972					
1973					
1974					
1975					
1976					
1977					
1978					
1979	3,989	8,228	4,239	26,769	22,530
1980	181,321	128,845	-52,476	131,455	183,931
1981	214,967	290,311	75,344	256,083	180,739
1982	139,519	247,650	108,131	240,436	132,305
1983	234,456	283,775	49,319	203,837	154,518
1984	317,986	410,439	92,453	404,015	311,562
1985	166,125	177,580	11,456	223,593	212,138
1986	530,471	549,475	19,004	443,932	424,928
1987	2,460,513	1,833,232	-627,281	1,979,296	2,606,577
1988	3,146,649	2,484,415	-662,234	2,691,135	3,353,369
1989	2,988,998	2,581,690	-407,308	2,828,089	3,235,397
1990	2,906,574	2,503,670	-402,904	2,518,448	2,921,352
1991	2,635,521	2,467,190	-168,331	2,578,361	2,746,692
1992	2,755,712	2,385,015	-370,697	2,505,215	2,875,912
1993	2,730,174	2,489,146	-241,028	2,494,776	2,735,804
1994	2,722,574	2,473,360	-249,214	2,248,241	2,497,455
1995	2,423,434	2,249,951	-173,483	2,244,138	2,417,621
1996	2,398,538	2,131,411	-267,127	1,938,081	2,205,208
1997	3,084,234	2,661,494	-422,740	2,328,237	2,750,977
1998	2,089,525	1,465,425	-624,100	2,074,809	2,698,909
1999	1,688,730	979,538	-709,192	1,503,800	2,212,992
2000	1,663,653	1,051,403	-612,250	1,260,584	1,872,834
2001	2,024,213	1,306,685	-717,528	909,545	1,627,073

Figure 39: Water Balance Thermal Projects Athabasca Area (m^3)

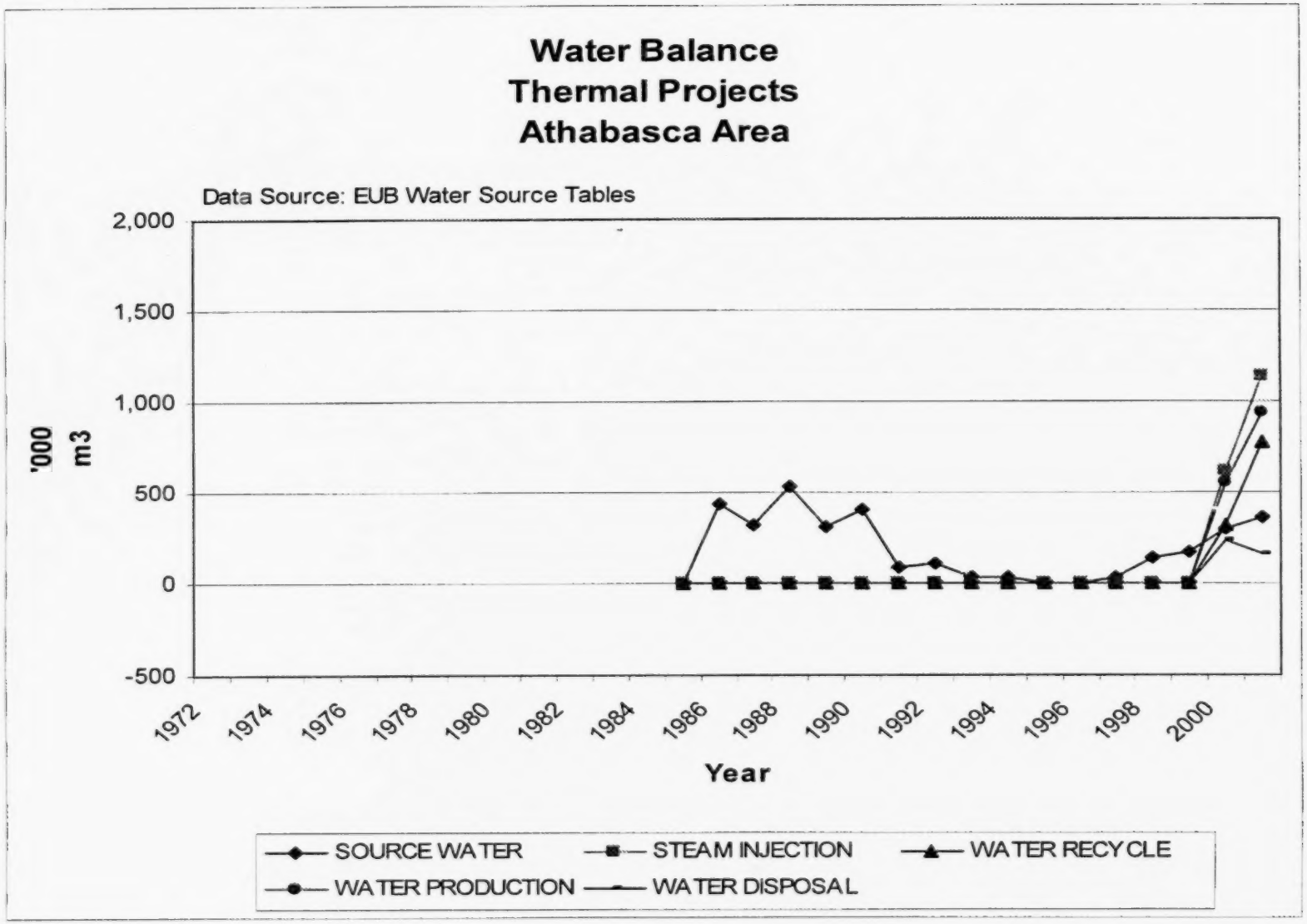

Table 39: Water Balance Thermal Projects Athabasca Area (m^3)

YEAR	SOURCE WATER	STEAM INJECTION	WATER RECYCLE	WATER PRODUCTION	WATER DISPOSAL
1972					
1973					
1974					
1975					
1976					
1977					
1978					
1979					
1980					
1981					
1982					
1983					
1984					
1985	4,087	0	0	0	0
1986	435,618	0	0	0	0
1987	323,149	0	0	0	0
1988	532,631	0	0	0	0
1989	310,145	0	0	0	0
1990	403,815	0	0	0	0
1991	88,595	0	0	0	0
1992	106,171	0	0	0	0
1993	31,954	0	0	0	0
1994	30,438	0	0	0	0
1995	950	0	0	0	0
1996	698	0	0	0	0
1997	35,979	0	0	0	0
1998	142,782	0	0	0	0
1999	167,137	0	0	0	0
2000	301,706	619,656	317,950	553,415	235,465
2001	364,984	1,140,168	775,184	937,518	162,334

Figure 40: Water Balance Thermal Projects Cold Lake (m^3)

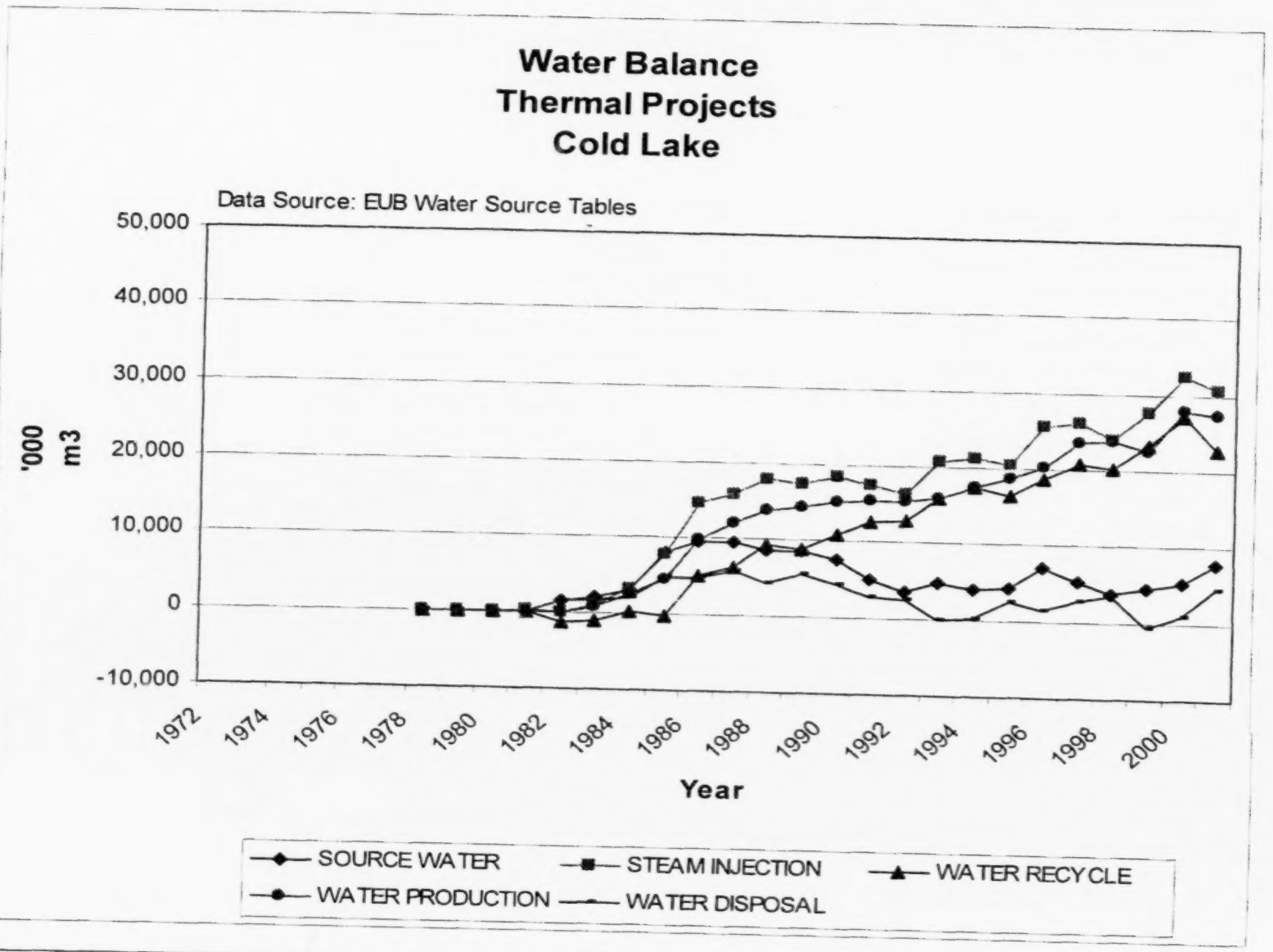

Table 40: Water Balance Thermal Projects Cold Lake (m^3)

YEAR	SOURCE WATER	STEAM INJECTION	WATER RECYCLE	WATER PRODUCTION	WATER DISPOSAL
1972					
1973					
1974					
1975					
1976					
1977					
1978	7,013	41,511	34,498	23,680	-10,818
1979	24,766	29,015	4,249	23,860	19,611
1980	688	29,536	28,848	37,901	9,053
1981	24,191	62,246	38,056	31,403	-6,653
1982	1,501,210	24,060	-1,477,150	30,468	1,507,618
1983	1,823,266	843,052	-980,214	763,785	1,743,999
1984	2,908,991	3,176,088	267,097	2,334,334	2,067,237
1985	8,034,468	7,776,203	-258,265	4,376,695	4,634,960
1986	9,606,549	14,548,028	4,941,479	9,788,166	4,846,687
1987	9,556,388	15,924,791	6,368,403	12,025,991	5,657,588
1988	8,558,179	17,987,797	9,429,618	13,781,631	4,352,013
1989	8,487,193	17,358,019	8,870,826	14,293,530	5,422,704
1990	7,445,990	18,405,605	10,959,616	15,225,715	4,266,100
1991	4,878,593	17,458,674	12,580,082	15,402,684	2,822,603
1992	3,438,599	16,414,443	12,975,844	15,437,485	2,461,641
1993	4,707,636	20,702,571	15,994,935	15,971,721	-23,214
1994	3,968,766	21,354,505	17,385,739	17,517,740	132,001
1995	4,192,611	20,510,593	16,317,982	18,717,465	2,399,483
1996	6,935,162	25,704,844	18,769,682	20,329,661	1,559,979
1997	5,327,093	26,075,200	20,748,108	23,535,292	2,787,185
1998	3,821,477	24,071,497	20,250,020	23,790,136	3,540,116
1999	4,460,807	27,642,304	23,181,497	22,667,631	-513,866
2000	5,276,156	32,392,079	27,115,923	27,944,026	828,103
2001	7,844,239	30,581,277	22,737,039	27,256,683	4,519,645

Figure 41: Total Source Water Use By Zone (m^3)

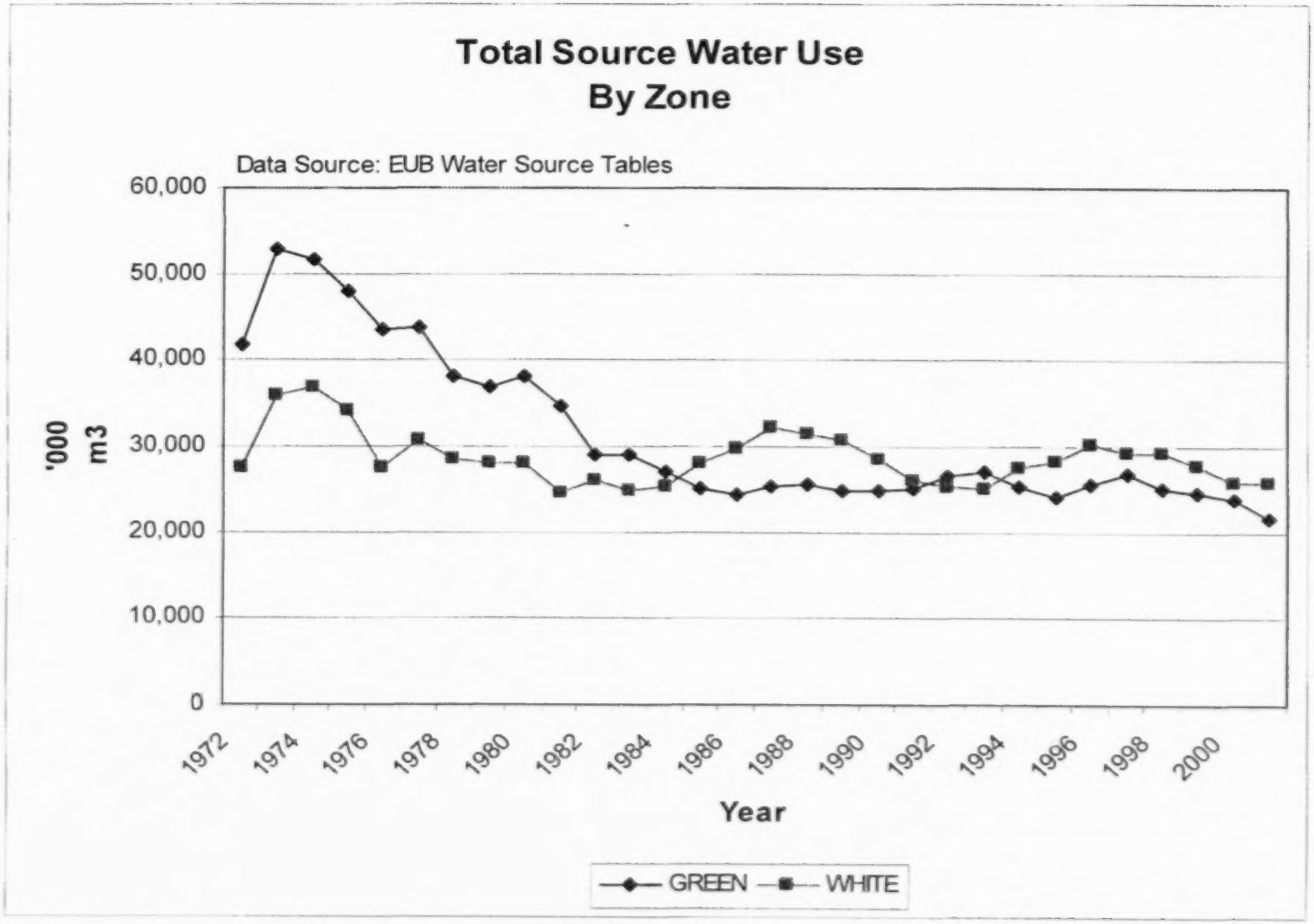

Table 41: Total Source Water Use By Zone (m^3)

YEAR	Total Of TOTAL	GREEN	WHITE
1972	69,497,060	41,855,539	27,641,521
1973	88,760,866	52,809,753	35,951,113
1974	88,445,795	51,578,394	36,867,401
1975	81,957,696	47,856,637	34,101,059
1976	70,914,481	43,483,221	27,431,260
1977	74,589,665	43,763,145	30,826,520
1978	66,570,914	38,164,660	28,406,254
1979	64,927,542	36,808,145	28,119,398
1980	66,002,338	38,064,251	27,938,087
1981	59,134,161	34,633,674	24,500,487
1982	55,100,832	28,983,119	26,117,712
1983	53,817,732	28,972,236	24,845,495
1984	52,333,347	27,047,011	25,286,335
1985	52,969,977	25,034,162	27,935,814
1986	54,230,308	24,360,462	29,869,846
1987	57,591,467	25,327,978	32,263,488
1988	57,178,472	25,638,193	31,540,280
1989	55,680,630	24,884,967	30,795,663
1990	53,382,267	24,898,807	28,483,460
1991	51,142,187	24,984,023	26,158,164
1992	51,896,993	26,648,711	25,248,282
1993	51,974,216	26,954,878	25,019,338
1994	52,726,620	25,206,000	27,520,621
1995	52,288,569	24,101,377	28,187,192
1996	55,715,065	25,588,988	30,126,077
1997	56,036,714	26,851,572	29,185,142
1998	54,365,122	25,192,055	29,173,067
1999	52,299,540	24,556,812	27,742,728
2000	49,645,811	23,772,826	25,872,985
2001	47,525,748	21,680,170	25,845,578

Figure 42: Total Saline Water Use By Zone (m^3)

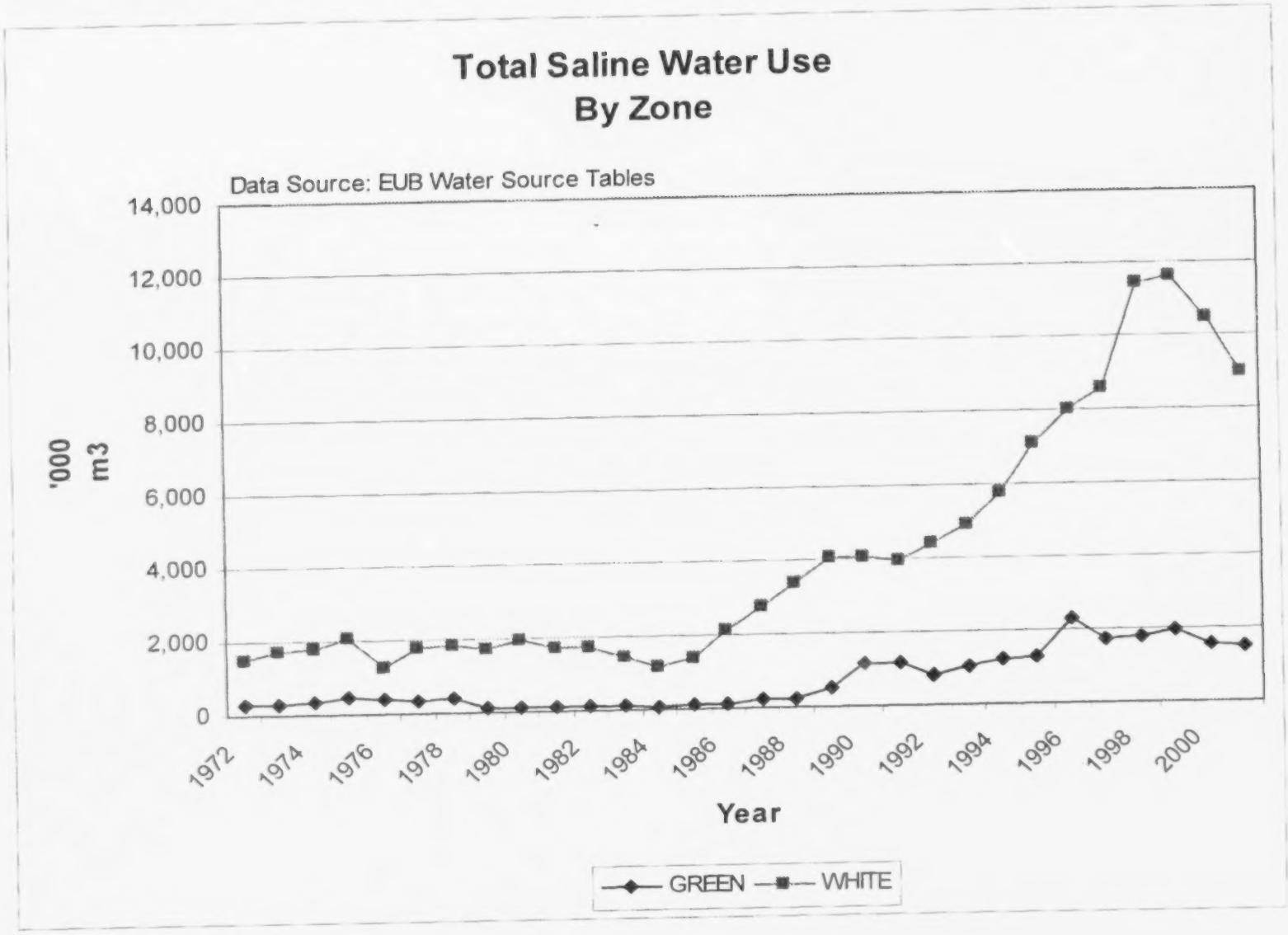

Table 42: Total Saline Water Use By Zone (m^3)

YEAR	Total Of TOTAL	GREEN	WHITE
1972	1,762,711	257,616	1,505,095
1973	2,004,389	298,611	1,705,777
1974	2,103,649	340,546	1,763,103
1975	2,508,997	433,628	2,075,369
1976	1,625,407	385,305	1,240,102
1977	2,097,720	349,493	1,748,227
1978	2,227,512	399,746	1,827,766
1979	1,834,898	125,175	1,709,723
1980	2,048,375	107,126	1,941,249
1981	1,841,987	114,552	1,727,435
1982	1,827,471	93,874	1,733,597
1983	1,541,752	112,282	1,429,471
1984	1,221,709	72,658	1,149,052
1985	1,510,992	128,413	1,382,579
1986	2,248,115	107,934	2,140,181
1987	2,969,379	224,910	2,744,469
1988	3,588,312	231,283	3,357,029
1989	4,560,012	490,929	4,069,084
1990	5,187,512	1,135,986	4,051,526
1991	5,077,549	1,151,429	3,926,120
1992	5,196,701	810,250	4,386,451
1993	5,906,020	1,003,334	4,902,685
1994	6,959,148	1,186,280	5,772,868
1995	8,388,711	1,285,581	7,103,129
1996	10,282,924	2,310,833	7,972,092
1997	10,297,236	1,732,582	8,564,654
1998	13,220,992	1,768,608	11,452,384
1999	13,521,459	1,915,948	11,605,511
2000	11,988,890	1,535,453	10,453,437
2001	10,424,625	1,476,316	8,948,309

Figure 43: Total Non-saline Water Use By Zone (m^3)

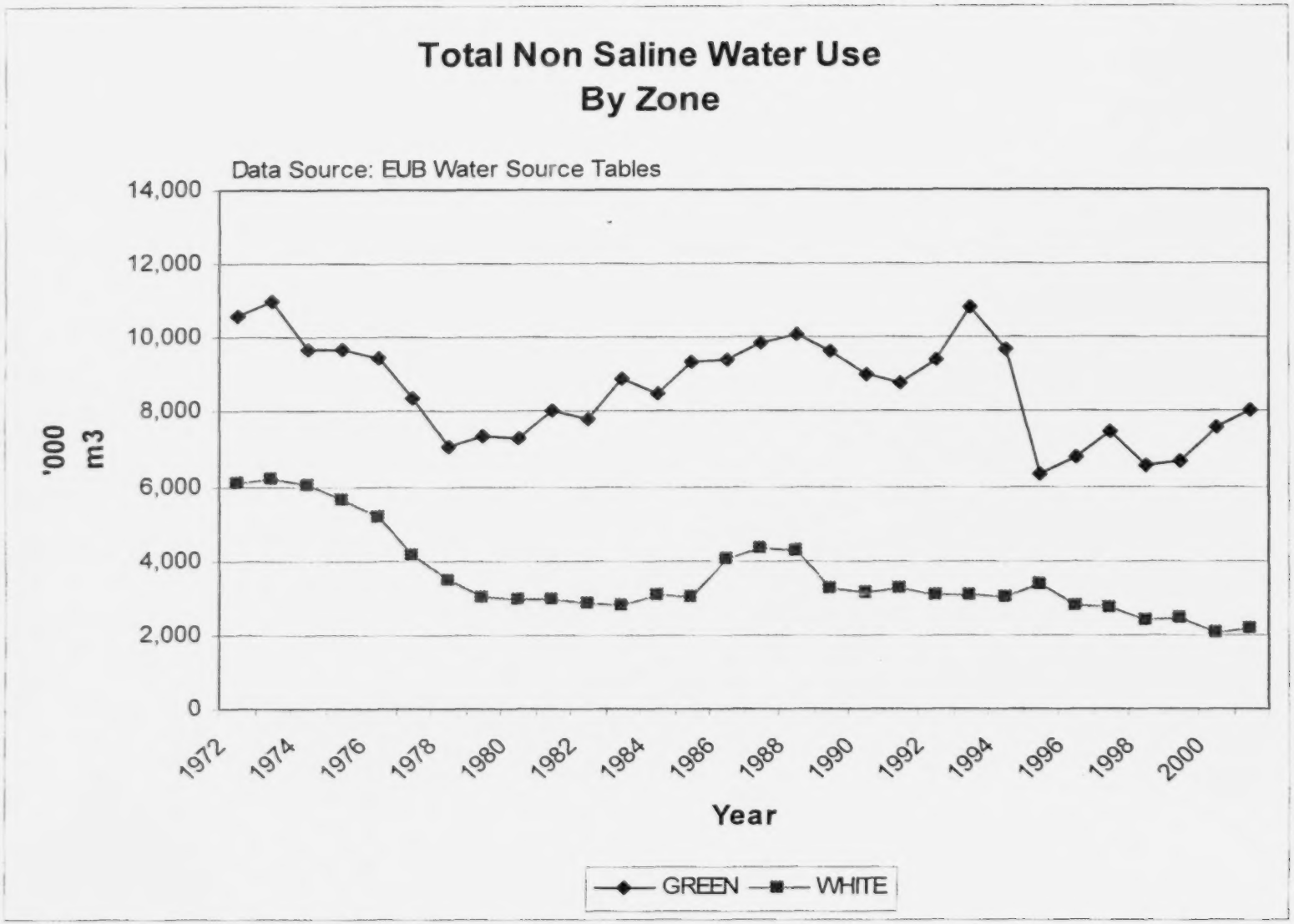

Table 43: Total Non-saline Water Use By Zone (m^3)

YEAR	Total Of TOTAL	GREEN	WHITE
1972	16,671,280	10,571,539	6,099,742
1973	17,180,840	11,005,840	6,175,000
1974	15,703,644	9,689,198	6,014,446
1975	15,297,300	9,671,289	5,626,011
1976	14,634,111	9,438,984	5,195,127
1977	12,509,086	8,349,405	4,159,680
1978	10,508,059	7,044,535	3,463,525
1979	10,330,523	7,314,055	3,016,468
1980	10,188,218	7,256,583	2,931,635
1981	11,019,623	8,052,767	2,966,856
1982	10,600,968	7,782,472	2,818,496
1983	11,643,709	8,869,840	2,773,869
1984	11,554,978	8,486,130	3,068,847
1985	12,366,511	9,343,714	3,022,797
1986	13,462,011	9,411,761	4,050,250
1987	14,187,014	9,835,026	4,351,988
1988	14,317,857	10,052,230	4,265,627
1989	12,869,420	9,607,414	3,262,006
1990	12,158,258	9,005,537	3,152,722
1991	12,054,653	8,785,066	3,269,587
1992	12,453,755	9,406,337	3,047,418
1993	13,906,141	10,824,834	3,081,306
1994	12,702,287	9,702,675	2,999,613
1995	9,698,103	6,328,245	3,369,858
1996	9,551,368	6,754,630	2,796,738
1997	10,199,530	7,447,702	2,751,828
1998	8,951,447	6,563,284	2,388,163
1999	9,104,218	6,642,059	2,462,159
2000	9,648,497	7,592,788	2,055,708
2001	10,157,259	8,012,652	2,144,608

Figure 44: Total Surface Water Use By Zone (m^3)

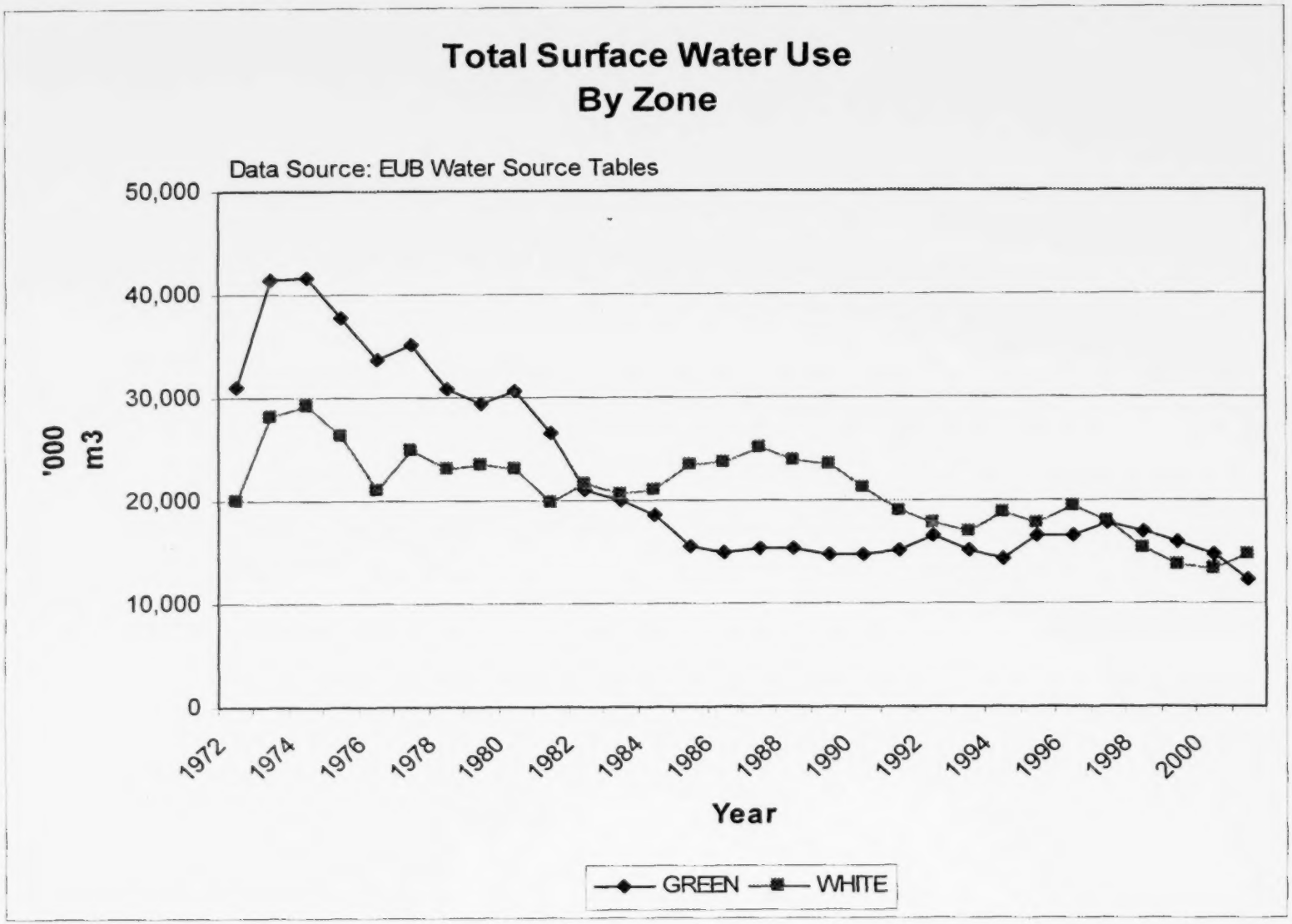

Table 44: Total Surface Water Use By Zone (m^3)

YEAR	Total Of TOTAL	GREEN	WHITE
1972	51,063,068	31,026,384	20,036,684
1973	69,575,638	41,505,302	28,070,336
1974	70,638,501	41,548,649	29,089,852
1975	64,151,399	37,751,720	26,399,679
1976	54,654,963	33,658,932	20,996,031
1977	59,982,860	35,064,247	24,918,613
1978	53,835,343	30,720,380	23,114,964
1979	52,762,121	29,368,915	23,393,206
1980	53,765,745	30,700,541	23,065,204
1981	46,272,551	26,466,356	19,806,195
1982	42,672,392	21,106,773	21,565,619
1983	40,632,271	19,990,115	20,642,156
1984	39,556,660	18,488,224	21,068,436
1985	39,092,474	15,562,036	23,530,439
1986	38,520,183	14,840,767	23,679,415
1987	40,435,073	15,268,042	25,167,031
1988	39,272,304	15,354,679	23,917,625
1989	38,251,198	14,786,625	23,464,573
1990	36,036,497	14,757,284	21,279,212
1991	34,009,984	15,047,527	18,962,457
1992	34,246,537	16,432,124	17,814,413
1993	32,162,055	15,126,709	17,035,346
1994	33,065,185	14,317,045	18,748,140
1995	34,201,755	16,487,551	17,714,205
1996	35,880,772	16,523,525	19,357,247
1997	35,539,948	17,671,288	17,868,659
1998	32,192,683	16,860,162	15,332,521
1999	29,673,863	15,998,804	13,675,058
2000	28,008,425	14,644,585	13,363,839
2001	26,943,864	12,191,202	14,752,662

Figure 45: Total Source Water Use By Drainage Basin (m^3)

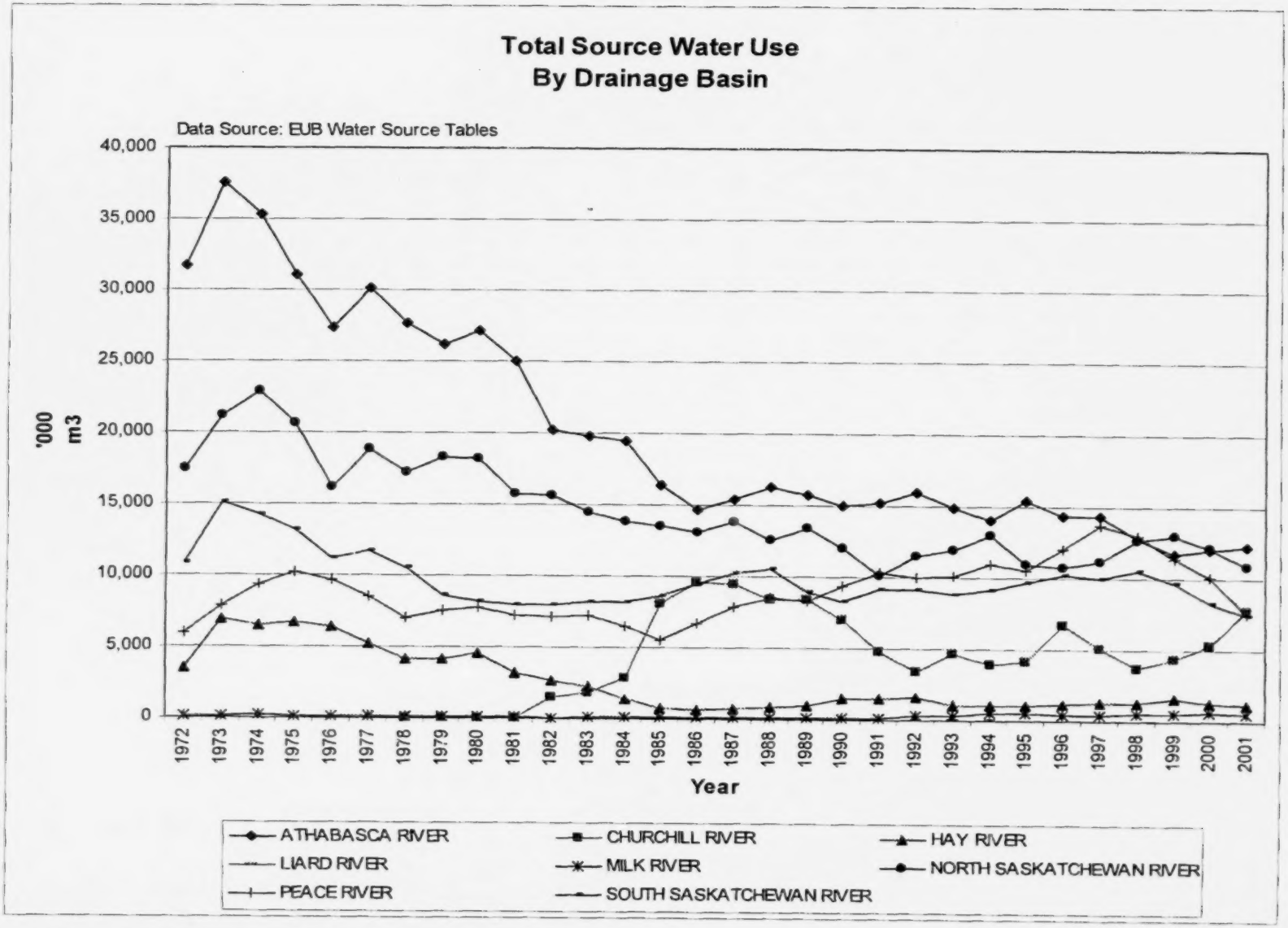

Table 45: Total Source Water Use By Drainage Basin (m^3)

YEAR	TOTAL	ATHABASCA RIVER	CHURCHILL RIVER	HAY RIVER	LIARD RIVER	MILK RIVER	NORTH SASKATCHEWAN RIVER	PEACE RIVER	SOUTH SASKATCHEWAN RIVER
1972	69,497,060	31,733,153		3,459,184		85,915	17,437,571	5,940,151	10,841,087
1973	88,760,866	37,605,546		6,864,354		138,203	21,126,777	7,916,579	15,109,408
1974	88,445,795	35,274,857		6,454,535		162,070	22,876,953	9,375,268	14,302,113
1975	81,957,696	31,027,874		6,707,197		72,258	20,685,408	10,240,547	13,224,413
1976	70,914,481	27,339,180		6,409,424		79,769	16,180,054	9,725,803	11,180,251
1977	74,589,665	30,138,600		5,262,063		62,321	18,864,879	8,536,803	11,724,999
1978	66,570,914	27,628,656	7,013	4,100,942		60,999	17,266,789	7,021,925	10,484,590
1979	64,927,542	26,160,248	24,766	4,175,981		75,064	18,289,915	7,544,296	8,657,272
1980	66,002,338	27,180,404	688	4,586,402		104,270	18,164,245	7,815,729	8,150,598
1981	59,134,161	24,970,245	11,728	3,148,443		67,078	15,762,600	7,229,251	7,944,817
1982	55,100,832	20,193,156	1,474,801	2,690,780		49,309	15,610,310	7,116,582	7,965,895
1983	53,817,732	19,756,304	1,811,385	2,205,273		76,006	14,493,844	7,273,288	8,201,633
1984	52,333,347	19,435,580	2,908,991	1,382,027		54,607	13,824,817	6,509,859	8,217,466
1985	52,969,977	16,410,113	8,034,468	737,623		57,574	13,521,011	5,562,319	8,646,870
1986	54,230,308	14,729,003	9,536,316	638,606		61,202	13,131,703	6,667,406	9,466,071
1987	57,591,467	15,438,216	9,446,956	734,011		100,399	13,844,547	7,854,206	10,173,132
1988	57,178,472	16,274,913	8,379,374	878,371		107,887	12,556,459	8,470,213	10,511,257
1989	55,680,630	15,756,346	8,395,069	911,155		97,056	13,380,193	8,247,036	8,893,774
1990	53,382,267	15,026,090	7,034,165	1,503,887		86,862	12,058,435	9,405,877	8,266,950
1991	51,142,187	15,179,830	4,762,760	1,492,685		141,214	10,060,278	10,334,172	9,171,248
1992	51,896,993	15,927,208	3,425,483	1,592,974	17,289	295,739	11,488,320	9,967,120	9,182,861
1993	51,974,216	14,945,422	4,668,452	1,071,642	2,503	369,797	11,927,117	10,111,298	8,877,986
1994	52,726,620	14,017,058	3,945,675	1,109,452	15,007	534,250	12,971,730	10,966,464	9,166,983
1995	52,288,569	15,395,652	4,123,824	1,070,875		511,584	10,992,990	10,520,874	9,672,771
1996	55,715,065	14,408,583	6,752,088	1,161,658		461,380	10,745,547	12,006,074	10,179,736
1997	56,036,714	14,338,057	5,090,703	1,252,120		404,329	11,173,028	13,735,407	10,043,070
1998	54,365,122	12,729,223	3,673,311	1,258,646		546,419	12,618,035	12,969,351	10,570,138
1999	52,299,540	11,721,819	4,394,088	1,543,775		577,373	12,996,964	11,338,581	9,726,939
2000	49,645,811	11,995,007	5,273,895	1,246,472		615,578	12,080,918	10,099,905	8,334,035
2001	47,525,748	12,190,829	7,808,704	1,162,202		539,101	10,803,525	7,545,809	7,475,578

Figure 46: Total Saline Water Use By Drainage Basin (m^3)

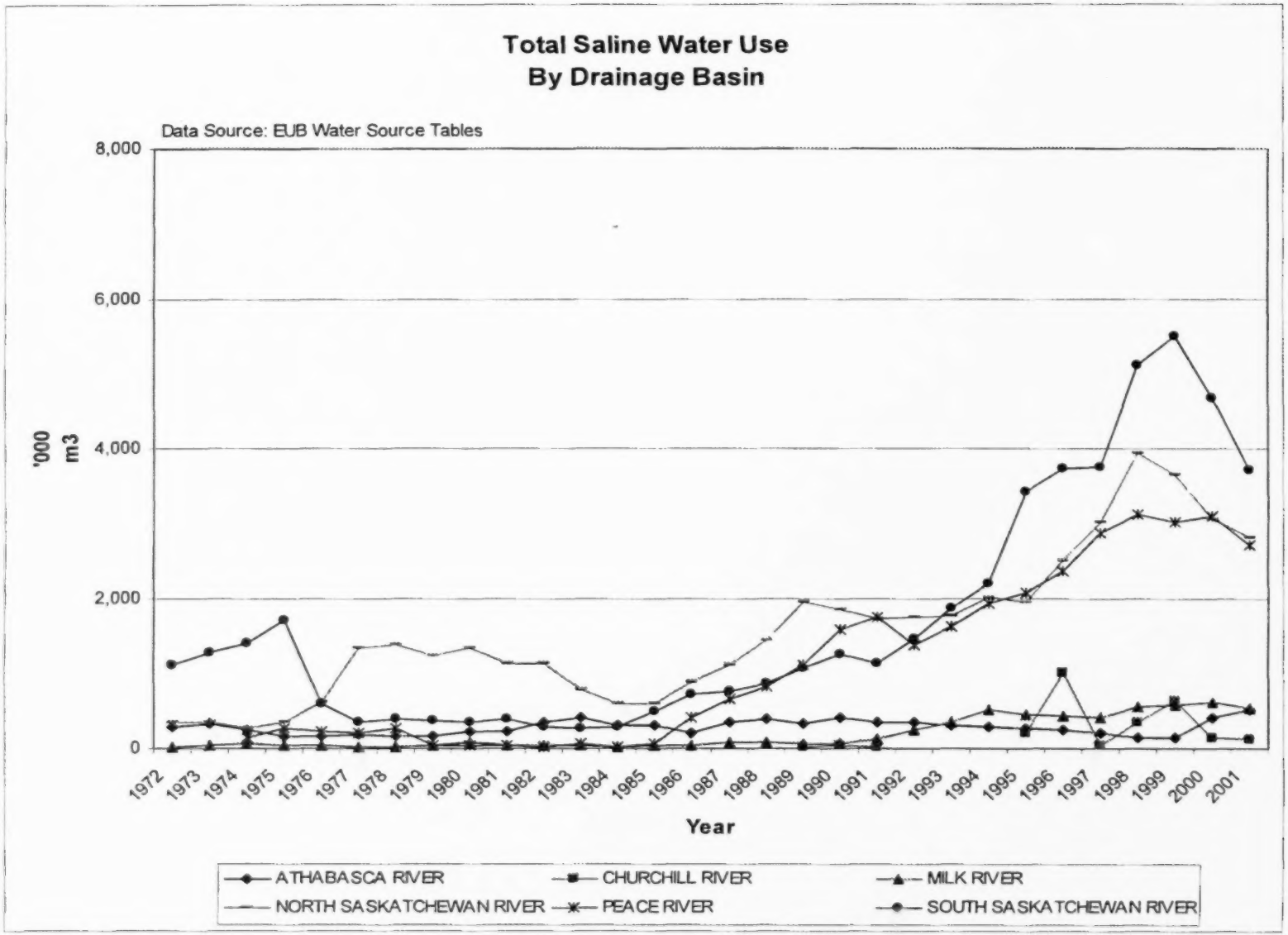

Table 46: Total Saline Water Use By Drainage Basin (m^3)

YEAR	TOTAL	ATHABASCA RIVER	CHURCHILL RIVER	MILK RIVER	NORTH SASKATCHEWAN RIVER	PEACE RIVER	SOUTH SASKATCHEWAN RIVER
1972	1,762,711	280,858		14,357	358,118		1,109,378
1973	2,004,389	333,291		44,374	344,885		1,281,838
1974	2,103,649	236,669		64,965	270,359	138,423	1,393,234
1975	2,508,997	168,573		31,959	341,396	270,640	1,696,428
1976	1,625,407	159,604		31,702	615,432	216,278	602,392
1977	2,097,720	188,134		21,403	1,336,080	210,053	342,049
1978	2,227,512	169,352		24,291	1,378,992	265,399	389,477
1979	1,834,898	156,409		43,065	1,234,382	34,995	366,048
1980	2,048,375	226,326		82,661	1,339,467	43,374	356,548
1981	1,841,987	234,716		43,400	1,136,194	31,813	395,864
1982	1,827,471	351,212		36,164	1,124,213	25,313	290,568
1983	1,541,752	400,469		44,344	776,922	53,600	266,418
1984	1,221,709	297,997		26,576	594,474	22,522	280,140
1985	1,510,992	310,858		31,171	602,240	71,261	495,463
1986	2,248,115	198,500		32,726	877,244	412,169	727,476
1987	2,969,379	348,572		88,433	1,117,844	660,433	754,098
1988	3,588,312	386,542		81,963	1,426,155	830,061	863,591
1989	4,560,012	334,425	17,711	71,213	1,953,349	1,116,970	1,066,344
1990	5,187,512	408,651	36,188	69,042	1,844,170	1,586,240	1,243,221
1991	5,077,549	348,942	12,958	114,682	1,718,239	1,753,436	1,129,293
1992	5,196,701	352,479		255,866	1,749,646	1,383,498	1,455,213
1993	5,906,020	299,804		344,902	1,768,738	1,629,677	1,862,899
1994	6,959,148	290,767		515,659	2,015,806	1,932,516	2,204,400
1995	8,388,711	256,621	212,560	459,782	1,948,276	2,080,007	3,431,465
1996	10,282,924	239,756	1,013,461	421,903	2,502,188	2,364,563	3,741,055
1997	10,297,236	208,999	43,370	404,329	3,023,888	2,869,825	3,746,825
1998	13,220,992	147,049	347,908	546,419	3,941,667	3,120,331	5,117,617
1999	13,521,459	149,273	628,561	577,373	3,645,712	3,015,234	5,505,307
2000	11,988,890	404,867	142,609	615,578	3,056,970	3,102,017	4,666,850
2001	10,424,625	513,329	129,783	539,101	2,813,557	2,711,657	3,717,198

Figure 47: Total Non-saline Water Use By Drainage Basin (m^3)

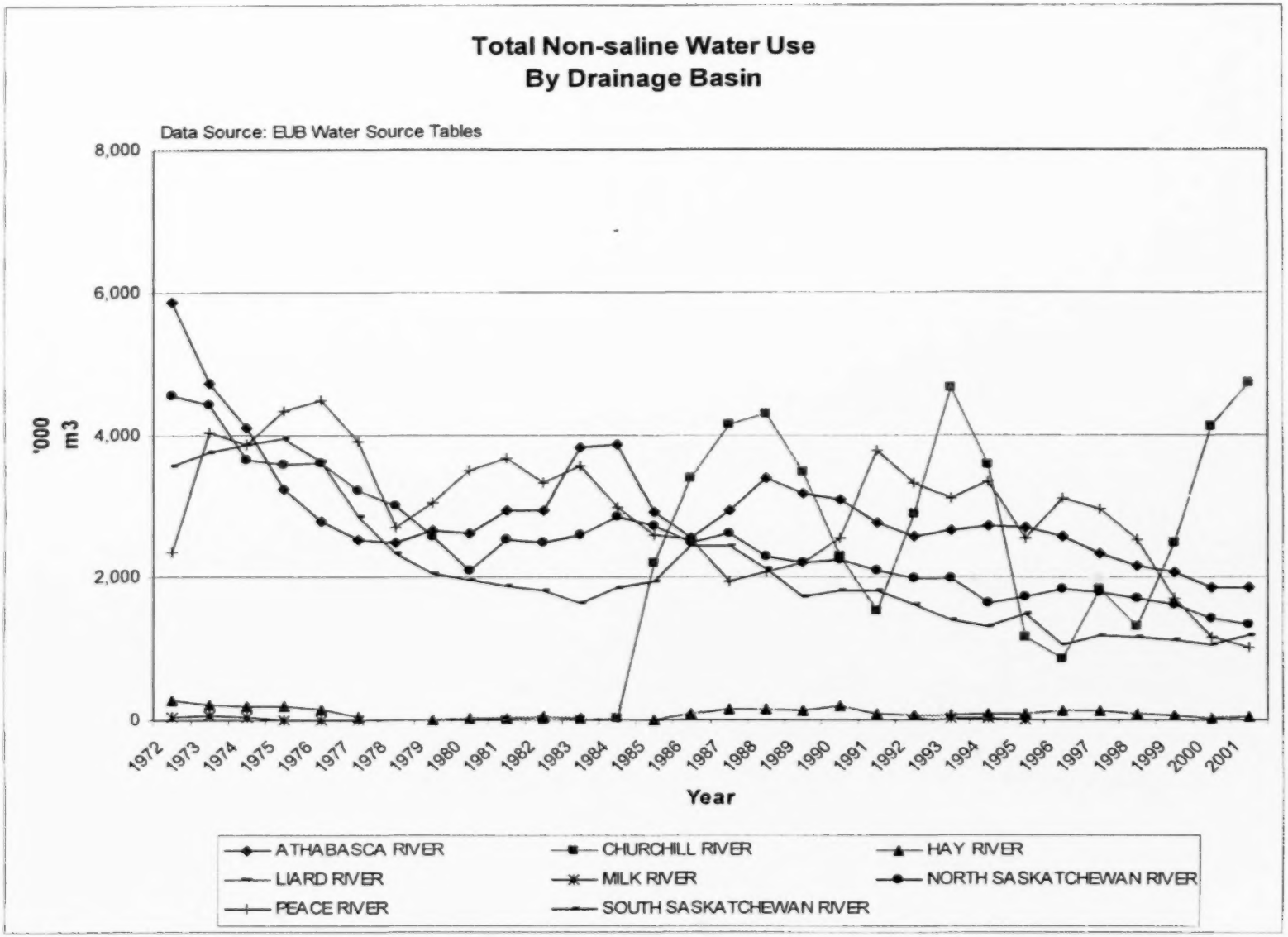

Table 47: Total Non-saline Water Use By Drainage Basin (m^3)

YEAR	TOTAL	ATHABASCA RIVER	CHURCHILL RIVER	HAY RIVER	LIARD RIVER	MILK RIVER	NORTH SASKATCHEWAN RIVER	PEACE RIVER	SOUTH SASKATCHEWAN RIVER
1972	16,671,280	5,869,296		287,842		51,049	4,545,095	2,357,427	3,560,573
1973	17,180,840	4,725,331		208,386		54,096	4,411,758	4,027,301	3,753,967
1974	15,703,644	4,101,900		197,582		45,363	3,636,098	3,865,260	3,857,442
1975	15,297,300	3,231,443		200,300		2,610	3,583,708	4,329,452	3,949,787
1976	14,634,111	2,782,011		142,061		5,096	3,608,277	4,477,846	3,618,821
1977	12,509,086	2,514,073		38,488		1,489	3,205,245	3,893,021	2,856,769
1978	10,508,059	2,487,755					3,001,561	2,694,286	2,324,457
1979	10,330,523	2,660,328		1,749			2,573,118	3,048,039	2,047,288
1980	10,188,218	2,606,582		30,952			2,097,454	3,488,369	1,964,861
1981	11,019,623	2,937,123	2,085	28,938			2,522,472	3,663,471	1,865,535
1982	10,600,968	2,941,184	592	46,507			2,486,770	3,310,367	1,815,548
1983	11,643,709	3,824,859	3,380	29,452			2,589,876	3,554,962	1,641,180
1984	11,554,978	3,860,741	20,029				2,837,724	2,981,518	1,854,965
1985	12,366,511	2,904,184	2,200,205	1,183			2,725,270	2,584,801	1,950,869
1986	13,462,011	2,539,373	3,385,581	84,426			2,482,195	2,527,589	2,442,846
1987	14,187,014	2,926,692	4,134,088	140,836			2,616,418	1,934,774	2,434,207
1988	14,317,857	3,382,725	4,299,298	155,017			2,295,874	2,072,769	2,112,175
1989	12,869,420	3,159,199	3,468,329	121,416			2,206,140	2,193,905	1,720,432
1990	12,158,258	3,084,247	2,277,090	201,778			2,245,913	2,542,803	1,806,427
1991	12,054,653	2,765,370	1,541,649	78,469			2,093,246	3,770,537	1,805,381
1992	12,453,755	2,568,116	2,896,327	64,433	17,289		1,980,049	3,312,254	1,615,287
1993	13,906,141	2,648,471	4,668,452	66,436	2,503	19,018	1,991,755	3,111,725	1,397,781
1994	12,702,287	2,725,726	3,575,094	78,379	15,007	12,523	1,629,034	3,341,754	1,324,770
1995	9,698,103	2,689,974	1,171,894	96,048		2,989	1,720,373	2,539,193	1,477,633
1996	9,551,368	2,570,403	866,972	132,115			1,824,952	3,099,471	1,057,455
1997	10,199,530	2,319,159	1,826,905	119,768			1,800,036	2,957,931	1,175,731
1998	8,951,447	2,146,454	1,322,063	85,714			1,699,070	2,531,736	1,166,411
1999	9,104,218	2,074,077	2,489,595	75,321			1,626,188	1,711,953	1,127,085
2000	9,648,497	1,862,965	4,110,191	29,951			1,427,050	1,167,141	1,051,199
2001	10,157,259	1,845,907	4,717,839	43,716			1,345,793	1,021,299	1,182,705

Figure 48: Total Surface Water Use By Drainage Basin (m^3)

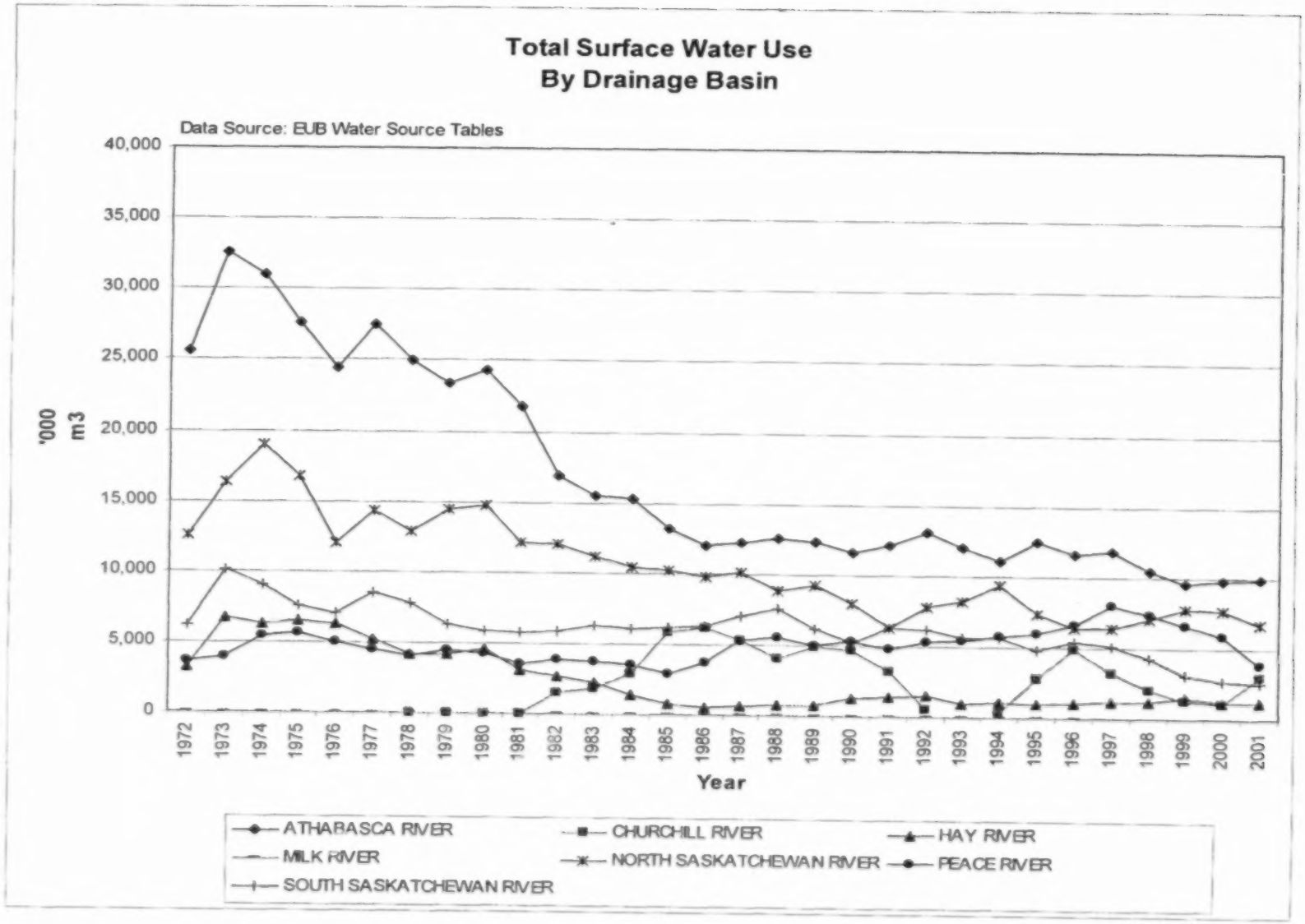

Table 48: Total Surface Water Use By Drainage Basin (m^3)

YEAR	TOTAL	ATHABASCA RIVER	CHURCHILL RIVER	HAY RIVER	MILK RIVER	NORTH SASKATCHEWAN RIVER	PEACE RIVER	SOUTH SASKATCHEWAN RIVER
1972	51,063,068	25,582,999		3,171,342	20,509	12,534,358	3,582,724	6,171,137
1973	69,575,638	32,546,924		6,655,968	39,732	16,370,134	3,889,278	10,073,602
1974	70,638,501	30,936,288		6,256,953	51,742	18,970,495	5,371,585	9,051,437
1975	64,151,399	27,627,858		6,506,897	37,689	16,760,303	5,640,455	7,578,198
1976	54,654,963	24,397,564		6,267,364	42,971	11,956,346	5,031,679	6,959,039
1977	59,982,860	27,436,393		5,223,575	39,429	14,323,553	4,433,728	8,526,182
1978	53,835,343	24,971,549	7,013	4,100,942	36,708	12,886,236	4,062,240	7,770,656
1979	52,762,121	23,343,511	24,766	4,174,232	31,999	14,482,415	4,461,262	6,243,936
1980	53,765,745	24,347,497	688	4,555,450	21,610	14,727,324	4,283,986	5,829,190
1981	46,272,551	21,798,406	9,643	3,119,505	23,677	12,103,934	3,533,968	5,683,418
1982	42,672,392	16,900,759	1,474,209	2,644,273	13,145	11,999,327	3,780,902	5,859,779
1983	40,632,271	15,530,976	1,808,005	2,175,821	31,662	11,127,046	3,664,726	6,294,036
1984	39,556,660	15,276,843	2,888,962	1,382,027	28,031	10,392,618	3,505,818	6,082,360
1985	39,092,474	13,195,071	5,834,263	736,440	26,403	10,193,502	2,906,257	6,200,539
1986	38,520,183	11,991,131	6,150,735	554,180	28,476	9,772,264	3,727,648	6,295,749
1987	40,435,073	12,162,953	5,312,868	593,175	11,966	10,110,286	5,258,999	6,984,827
1988	39,272,304	12,505,646	4,080,076	723,354	25,924	8,834,430	5,567,383	7,535,491
1989	38,251,198	12,262,722	4,909,029	789,740	25,843	9,220,704	4,936,162	6,106,998
1990	36,036,497	11,533,192	4,720,887	1,302,109	17,821	7,968,353	5,276,833	5,217,302
1991	34,009,984	12,065,517	3,208,153	1,414,216	26,533	6,248,793	4,810,200	6,236,573
1992	34,246,537	13,006,614	529,156	1,528,541	39,873	7,758,625	5,271,368	6,112,361
1993	32,162,055	11,997,146		1,005,206	5,877	8,166,625	5,369,896	5,617,305
1994	33,065,185	11,000,565	370,581	1,031,073	6,068	9,326,890	5,692,194	5,637,814
1995	34,201,755	12,449,057	2,739,370	974,827	48,813	7,324,342	5,901,674	4,763,674
1996	35,880,772	11,598,424	4,871,655	1,029,543	39,477	6,418,407	6,542,040	5,381,227
1997	35,539,948	11,809,899	3,220,428	1,132,352		6,349,104	7,907,650	5,120,515
1998	32,192,683	10,435,721	2,003,340	1,172,932		6,977,298	7,317,284	4,286,110
1999	29,673,863	9,498,469	1,275,932	1,468,454		7,725,065	6,611,395	3,094,548
2000	28,008,425	9,727,175	1,021,096	1,216,521		7,596,899	5,830,747	2,615,987
2001	26,943,864	9,831,593	2,961,082	1,118,486		6,644,175	3,812,854	2,575,674

Figure 49: Provincial Disposal Volumes (m^3)

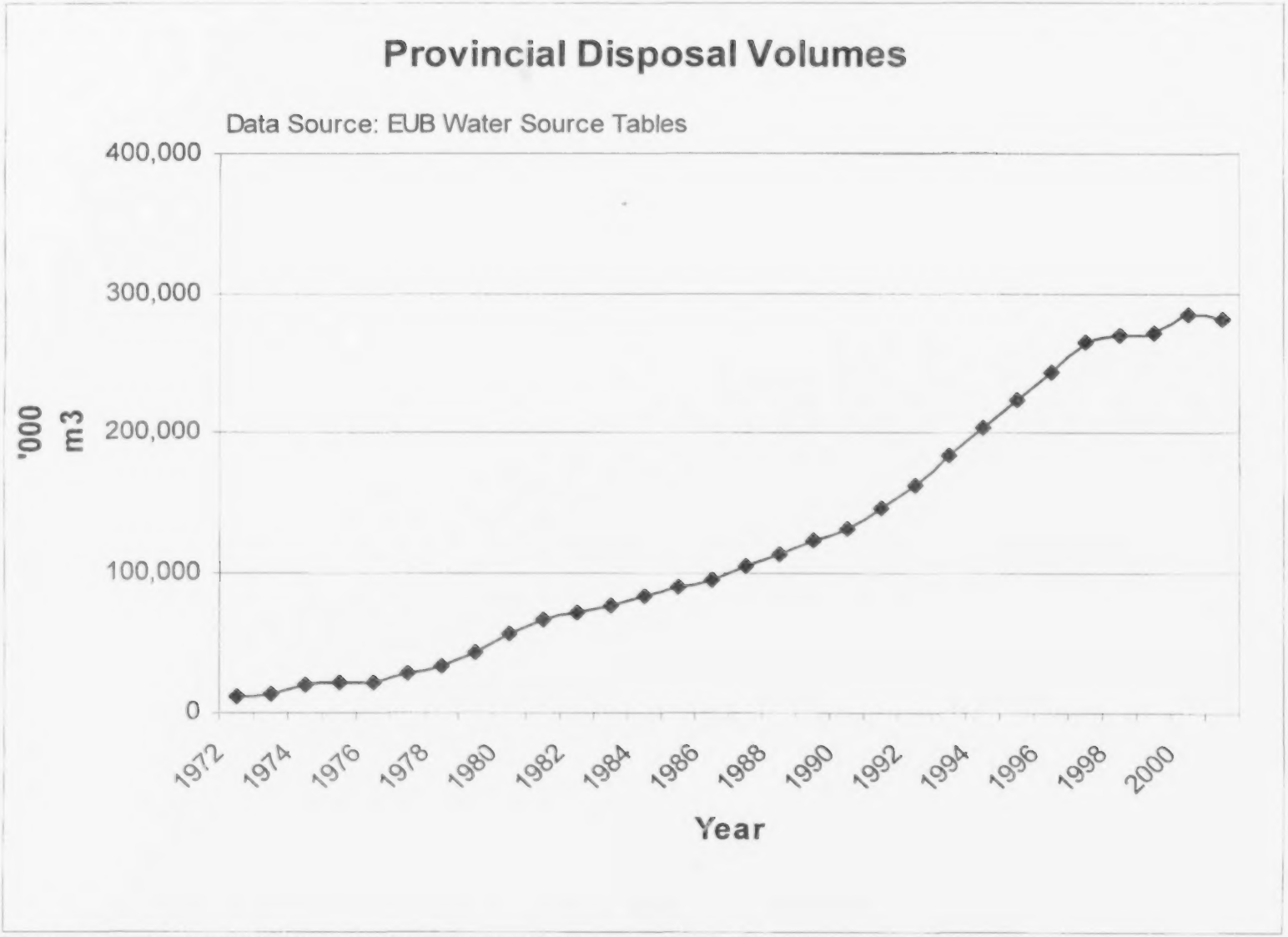

Table 49: Provincial Disposal Volumes (m^3)

Year	Disposal
1972	11,510,190
1973	13,672,453
1974	20,066,660
1975	22,094,848
1976	22,126,430
1977	28,236,206
1978	32,847,035
1979	43,087,700
1980	55,490,881
1981	65,564,419
1982	70,848,436
1983	76,181,200
1984	82,534,382
1985	89,633,681
1986	94,118,318
1987	103,876,337
1988	112,617,324
1989	122,795,752
1990	131,253,305
1991	146,196,713
1992	162,464,359
1993	183,630,939
1994	202,671,521
1995	222,964,195
1996	242,815,692
1997	264,501,776
1998	268,702,819
1999	271,441,521
2000	284,099,012
2001	281,233,550

Figure 50: Ground Water classification (m^3)

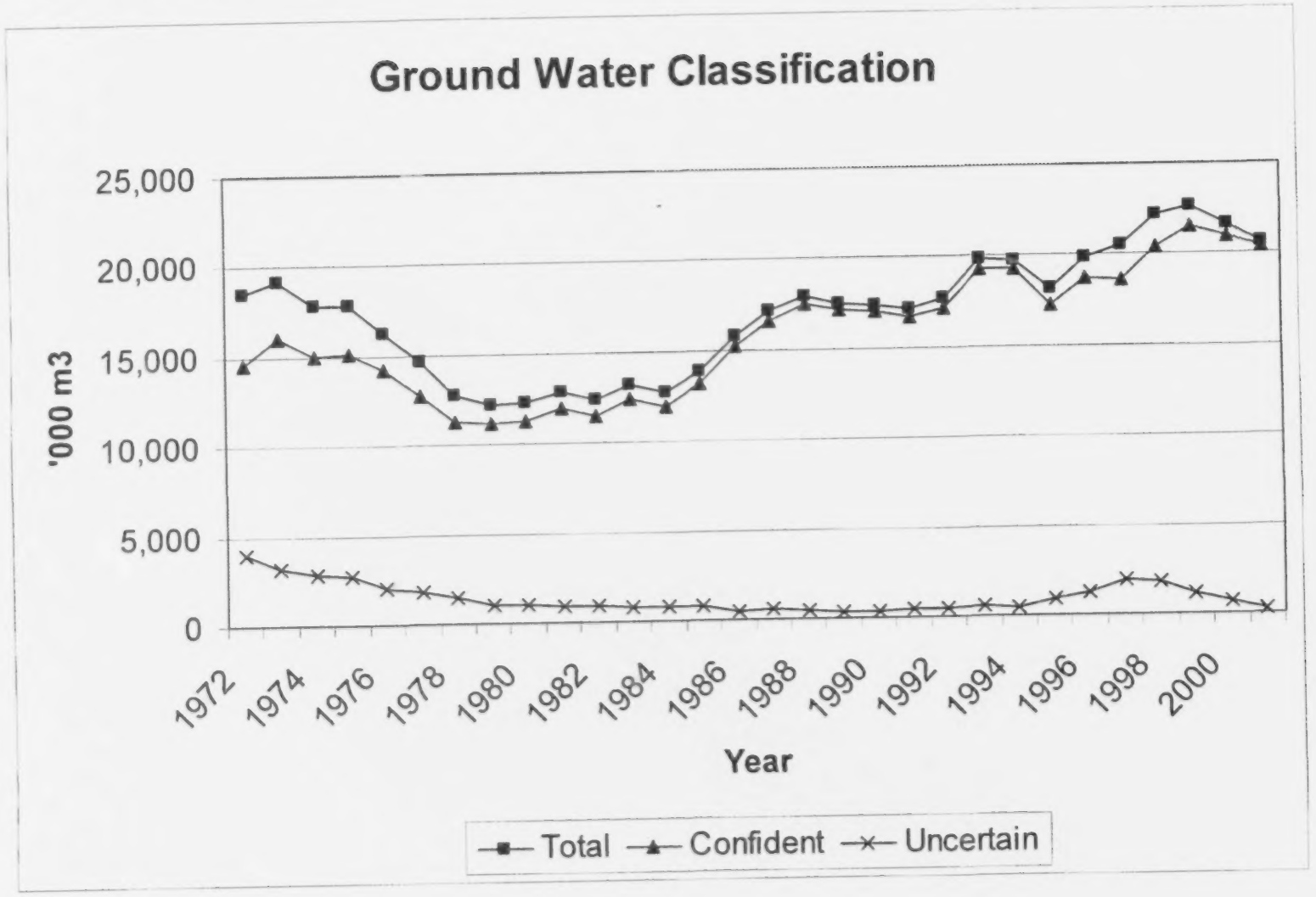

Table 50: Ground Water Classification (m^3)

YEAR	Total	Confident	Uncertain
1972	18433992	14476792	3957200
1973	19185228	15997947.8	3187281
1974	17807294	15006411.4	2800882
1975	17806297	15103307.1	2702990
1976	16259518	14239151.4	2020367
1977	14606805	12753744.8	1853060
1978	12735571	11282525.8	1453045
1979	12165421	11197326.9	968094.2
1980	12236593	11238373.2	998219.8
1981	12861610	11952355.8	909253.9
1982	12428439	11492849.1	935590.2
1983	13185461	12407927.1	777533.7
1984	12776687	11990357.6	786329.3
1985	13877503	13129076.9	748425.6
1986	15710125	15236137.9	473987.4
1987	17156394	16602427.6	553965.9
1988	17906169	17472313.2	433855.3
1989	17429432	17096690.8	332741.5
1990	17345770	16963086.7	382683.5
1991	17132202	16722026.4	410175.9
1992	17650456	17145098.7	505357.7
1993	19812160	19292027.1	520133.1
1994	19661435	19210411	451024.2
1995	18086814	17196961.9	889851.8
1996	19834293	18646412	1187881
1997	20496766	18567444	1929322
1998	22172439	20355178.3	1817261
1999	22625677	21535763.4	1089914
2000	21637386	20999200.2	638186.2
2001	20581884	20336684.3	245199.6

Figure 51: Sum of annual water allocation (m^3)

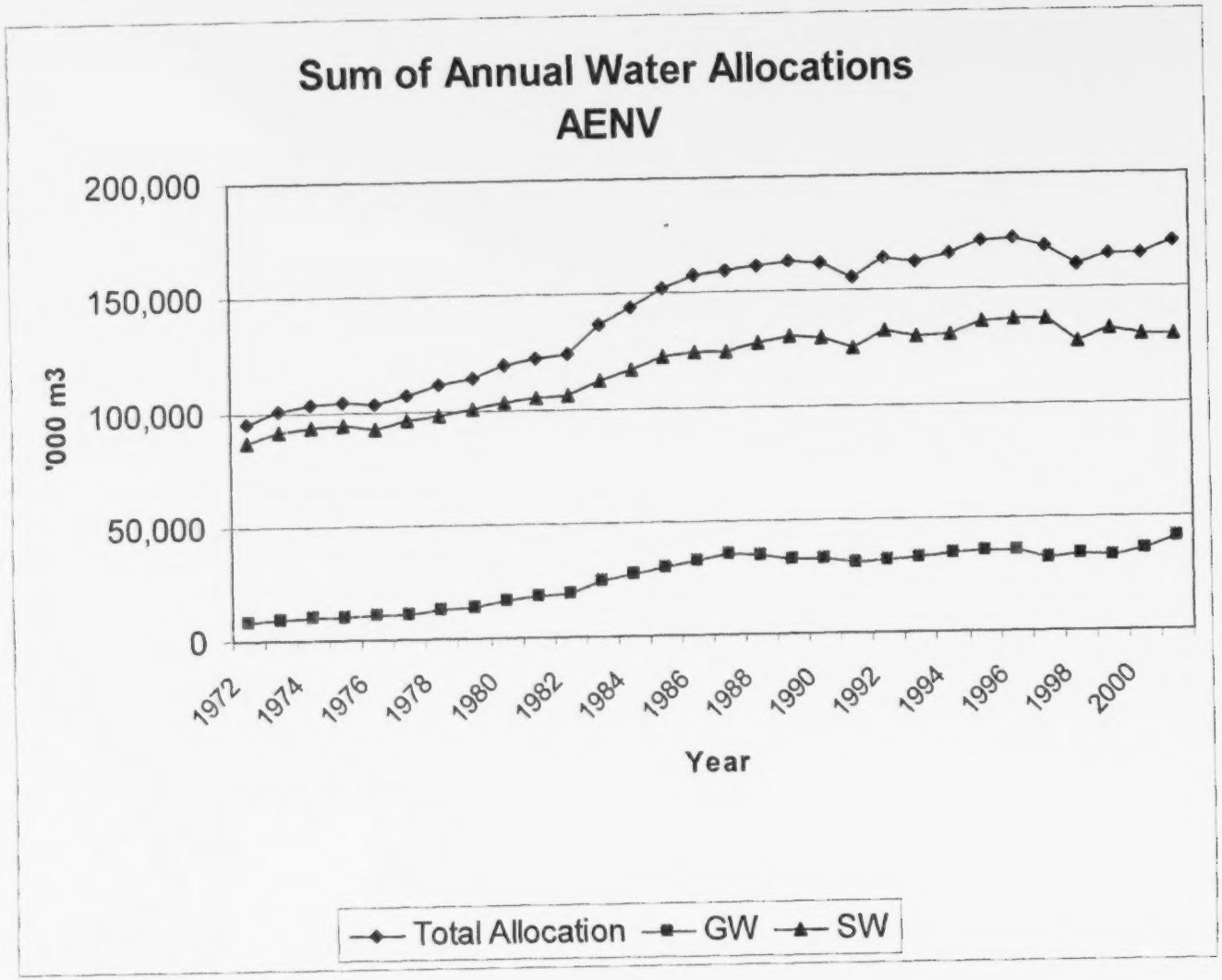

Table 51: Sum of annual water allocation (m^3)

Year	Total Allocation	GW	SW
1972	94695172.34	7926625	86768547.79
1973	100549262.3	9415435	91133827.79
1974	103071731.3	9618955	93452776.76
1975	104213911.3	10314625	93899286.76
1976	103476291.3	10748805	92727486.76
1977	106787941.3	11023625	95764316.76
1978	110948471.3	12972525	97975946.76
1979	113684671.3	13611805	100072866.8
1980	119100881.3	15878945	103221936.8
1981	122605201.3	17853745	104751456.8
1982	124330630.4	18782354	105548276.8
1983	136914328.9	24494332	112419996.8
1984	143877588.5	26952912	116924676.8
1985	152272938.5	30311932	121961006.8
1986	157026692.1	33018095	124008596.8
1987	159048444.1	34994197	124054246.8
1988	161526744.1	34239537	127287206.8
1989	163140144.1	33018397	130121746.8
1990	162129942.3	33023356	129106586.8
1991	155359642.3	30355636	125004006.8
1992	164027775.6	31652509	132375266.8
1993	161971545.6	32740469	129231076.8
1994	165272215.6	34602629	130669586.8
1995	170824099.6	35197319	135626780.8
1996	172151039.6	35206809	136944230.8
1997	167922692.1	31490341	136432350.8
1998	160233148.2	33586257	126646890.8
1999	164747152.2	32990261	131756890.8
2000	164888687.2	35650846	129237840.8
2001	169775689.2	40574838	129200850.8

Figure 52: Thermal project data and source water data (m^3)

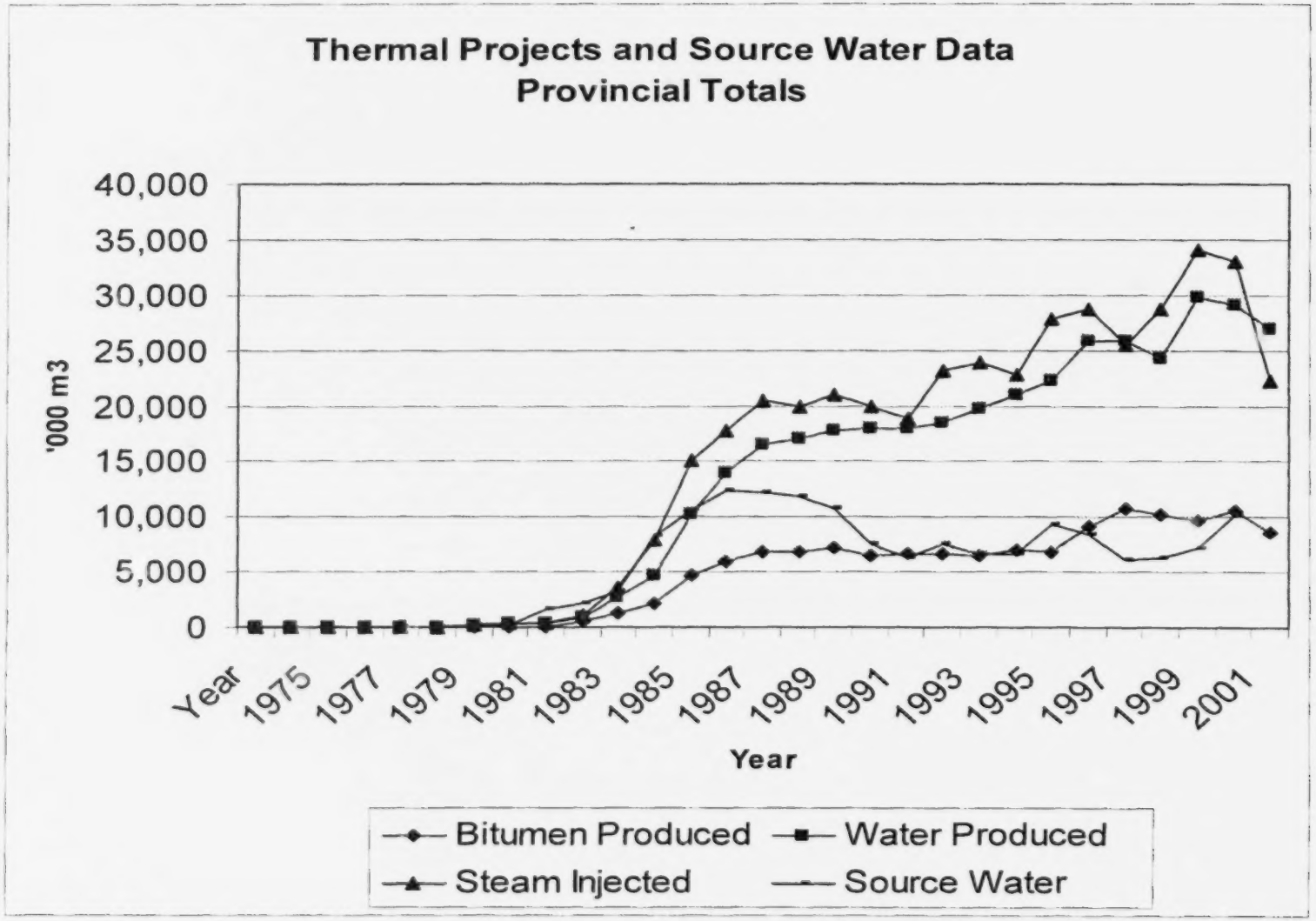

Table 52: Thermal project data and source water (m^3)

Year	Bitumen Produced	Water Produced	Steam Injected	Source Water
1974	1456	958	4792	
1975	1728	2557	14429	
1976	4980	9206	19704	
1977	5558	19946	33544	
1978	9525	23680	41511	7520.1
1979	5841	50629	37243	31768.2
1980	26284	169356	158381	184317.9
1981	50951	287486	352557	241097.7
1982	79696	270904	271710	1646814.4
1983	486541	967622	1126827	2071889.1
1984	1273461	2738349	3586527	3242211.2
1985	2215456	4600288	7953783	8204678.8
1986	4582033	10232098	15097503	10572637.6
1987	5935317	14005287	17758023	12340049.9
1988	6741142	16472766	20472212	12237459.3
1989	6786436	17121619	19939709	11786336.2
1990	7130309	17744163	20909275	10756378.1
1991	6504206	17981045	19925864	7602708.8
1992	6647067	17942700	18799458	6300481.8
1993	6695908	18466497	23191717	7469763.9
1994	6518434	19765981	23827865	6721778.5
1995	7020247	20961603	22760544	6616995.2
1996	6855869	22267742	27836255	9334398.1
1997	9059605	25863529	28736694	8447305.3
1998	10781945	25864945	25536922	6053783.6
1999	10268619	24171431	28621842	6316674.6
2000	9663693	29758025	34063138	7241515
2001	10545481	29103746	33028130	10233435.7

Figure 53: Recycle rates for conventional projects (water recycle / water production)

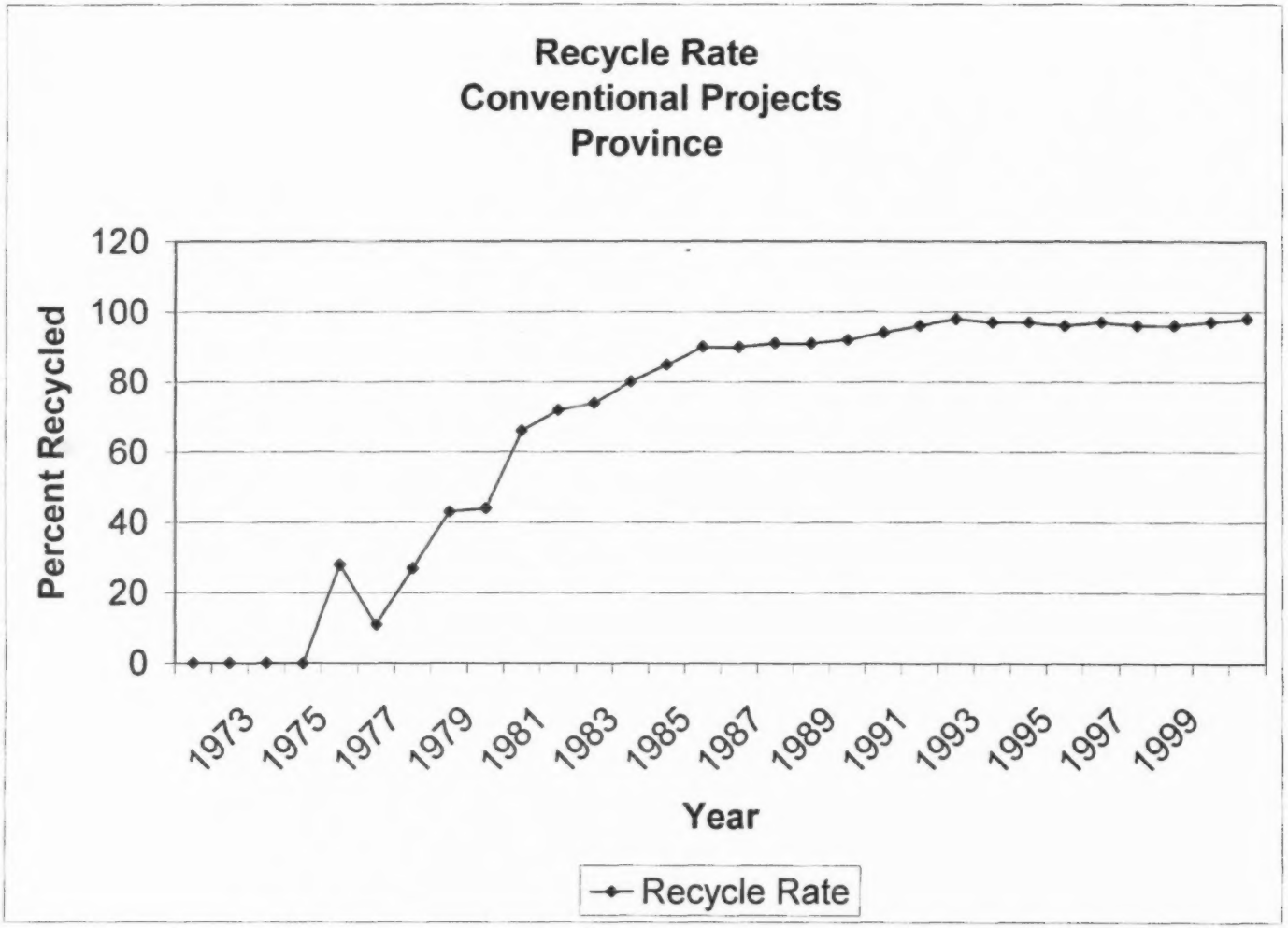

Table 53: Recycle rates for conventional projects (water recycle / water production)

	SOURCE WATER	WATER INJECTION	WATER RECYCLE	WATER PRODUCTION	WATER DISPOSAL	OIL PRODUCED	Recycle Rate
1972	69497059.8	69159263	-337796.8	9501042	9838838.8	33413388	0
1973	88760866.2	86643328	-2117538.2	12316621	14434159.2	39832073	0
1974	88445794.7	87606144	-839650.7	15050957	15890607.7	37210241	0
1975	81957695.9	81983532	25836.1	16975685	16949848.9	33262194	0
1976	70914481.1	76240384	5325902.9	18928470	13602567.1	30928601	28
1977	74589664.7	77107804	2518139.3	22449444	19931304.7	30880626	11
1978	66563394	73363962	6800568	25631345	18830777	29863712	27
1979	64895774.2	77510091	12614316.8	29197344	16583027.2	31086855	43
1980	65818020.2	79671664	13853643.8	31828001	17974357.2	29236219	44
1981	58893063.2	84165963	25272899.8	38285209	13012309.2	29001151	66
1982	53454017.2	83487132	30033114.8	41605698	11572583.2	28141428	72
1983	51745842.4	86259859	34514016.6	46649572	12135555.4	28942745	74
1984	49091135.4	91892242	42801106.6	53354138	10553031.4	30515431	80
1985	44765297.7	98488622	53723324.3	63188994	9465669.7	29778818	85
1986	43657670.2	113725671	70068000.8	77663961	7595960.2	29081045	90
1987	45251416.8	122706262	77454845.2	85803246	8348400.8	30204885	90
1988	44941013.1	130974895	86033881.9	94628361	8594479.1	31501129	91
1989	43894293.6	133477038	89582744.4	97961433	8378688.6	30097258	91
1990	42625888.6	140624060	97998171.4	106211901	8213729.6	28840972	92
1991	43539477.7	150039098	106499620.3	113196391	6696770.7	27895698	94
1992	45596511.6	159752711	114156199.4	119487644	5331444.6	27742071	96
1993	44504451.6	164094317	119589865.4	122468298	2878432.6	27011975	98
1994	46004841.7	174832957	128828115.3	133005404	4177288.7	26881983	97
1995	45671573.9	186248402	140576828.1	144396402	3819573.9	27268597	97
1996	46380666.8	197139461	150758794.2	157000304	6241509.8	26960743	96
1997	47589408.2	211895288	164305879.8	169707893	5402013.2	25764693	97
1998	48311338.3	220133156	171821817.7	179893826	8072008.3	24840116	96
1999	45982865.4	229995138	184012272.6	191323204	7310931.4	22963976	96
2000	42404295.9	241667033	199262737.1	205774476	6511738.9	21303707	97
2001	37292312.3	243415291	206122978.7	211190675	5067696.3	19068952	98